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Section of the History of Medicine.

President—Dr. R. O. Moon.

[*April* 6, 1932.]

The Preface of Andreas Vesalius to *De Fabrica Corporis Humani 1543.*

Translated by B. Farrington (Cape Town).

Translator's Note.—In the preface to *De Humani Corporis Fabrica* a master-spirit speaks of himself and of his work. Twenty-eight years of age, professor of anatomy in three universities of Italy, his prolonged and arduous researches completed and the results digested into the first great masterpiece of modern science, he presents himself to the reader at the supreme crisis of his career. He is entirely conscious of his own worth and of the importance of the rôle for which he is cast. In the forefront of his work he sets two illustrations. First, the woodcut portrait of himself exhibiting the muscles that control the hand, a famous and decisive moment in his career. Second, the symbolic scene in which, before an enthralled and crowded assembly, he dissects a corpse in person, banishing for ever the old atmosphere of lector, demonstrator, dependence upon authority, and boredom. The same story is told in the prefatory dedication, and it is the translator's task to choose a style that will best offer to the modern reader a living contact with the man and the moment.

Translation is always a compromise and never easy. The Latin of Vesalius is a very accomplished medium. He can give a clear and simple description of the parts of the human body and their functions. He can give (and this is not easy in any language) precise, intelligible instructions for the execution of complicated operations, as witness his final chapter —on vivisection. He can tell an anecdote with point and spirit. But he can also write in an elaborate rhetorical style, as he has, for instance, in this dedication, wherein the periods grow to an unwieldy bulk, wherein redundancies are admitted or sought after in order to swell the rolling rhythms, wherein the folds of classical rhetoric in a dead, learned language drape themselves with a comical heaviness about the clean, stripped thought.

My version is intended to be both close and faithful; but I have deliberately lightened and modernized the style by introducing paragraphs (none are indicated in the original), by breaking up the periods, and by pruning occasional redundancies. I hope that these concessions to the convenience and taste of the modern reader have not allowed the character of the man and the epoch wholly to evaporate.

The translation has been made from the text as edited by Boerhaave and Albinus in 1725. The beginning of each page of the first edition of 1543 has been indicated in the left-hand margin. For the satisfaction of those interested in the terminology of Vesalius, some of the more important Latin terms have been given at the foot of the page.

I am indebted to Dr. Charles Singer for corrections and improvements in my version of the text, and also for the addition of notes from his own store of knowledge.

The Preface of Andreas Vesalius to *His Own Books on the Mechanism of the Human Body addressed to The Most Great and Invincible Emperor* The Divine Charles V.

Those engaged in the arts and sciences, Most Gracious Emperor Charles, find many serious obstacles to the exact study and successful application of them. In the first place, no slight inconvenience results from too great separation between branches of study which serve for the perfection of one art. But much worse is the mischievous distribution among different practitioners of the practical applications of the art. This has been carried so far that those who have set before themselves the attainment of an art embrace one part of it to the neglect of the rest, although they are intimately bound up with it and can by no means be separated from it. Such never achieve any notable result; they never attain their goal, or succeed in basing their art upon a proper foundation.

I shall pass over all the other arts in silence and confine myself to a few remarks on that which presides over the health of mankind. This, of all the arts which the mind of man has discovered, is by far the most beneficial, necessary, abstruse and laborious. But in bygone times, that is to say [in the West] after the Gothic deluge and [in the East] after the reign of Mansor at Bochara in Persia, under whom, as we know, the Arabs still lived as was right on terms of familiarity with the Greeks, medicine began to be sore distempered. Its primary instrument, the employment of the hand in healing,[1] was so neglected that it was relegated to vulgar fellows with no instruction whatsoever in the branches of knowledge that subserve the art of medicine.

In ancient times there were three medical sects, to wit, the Dogmatic, the Empirical and the Methodical,[2] but the exponents of each of these embraced the whole of the art as the means to preserve health and war against disease. To this end they referred all that they individually thought necessary in their particular sects, and employed the service of a threefold aid to health: first, a theory of diet; secondly, the whole use of drugs; and thirdly, manual operation.[3] This last, above the rest, nicely proves the saying that medicine is the addition of that which is defective and the removal of that which is in excess; as often as we resort to the art of medicine for the treatment of disease we have occasion to employ it; and time and experience have taught, by the benefits it has conferred, that it is the greatest aid to human health.

This triple manner of treatment was equally familiar to the doctors[4] of each sect; and those who applied manual operation according to the nature of the affection, expended no less care in training their hands than in establishing a theory of diet, or in learning to recognize and compound drugs. This, not to mention his other books, is clearly shown by those most perfect of the compositions of Hippocrates: *On the Function of the Doctor, On Fractures of Bones, On Dislocations of Joints and Similar*

1 *Primarium eius instrumentum manus operam in curando adhibens. . . . Manus opera* = χειρουργία.
2 *Tres medicorum sectae, Logica, Empirica et Methodica.*
3 *Manus opera.*
4 *Medici.*

Ailments. Nay more, Galen, after Hippocrates the prince of medicine, in addition to the fact that he boasts from time to time that the care of the gladiators of Pergamum was entrusted to his sole charge, and that when age was now becoming a burden he was reluctant for the monkeys he had for dissection to be skinned by the help of slaves, frequently impresses on us his joy in manual dexterity and how zealously he, in common with the other doctors of Asia, employed it. Indeed, there is no one of the ancients who does not seem as solicitous to hand down to posterity the method of cure which is effected by the hand as those methods which depend on diet and drugs.

But it was especially after the ruin spread by the Goths, when all the sciences, which before had flourished gloriously and were practised as was fitting, went to ruin, that more fashionable doctors, first in Italy, in imitation of the old Romans, despising the work of the hand, began to delegate to slaves the manual attentions which they judged needful for their patients, and themselves merely to stand over them like master builders.[5] Then, when all the rest also who practised the true art of healing gradually declined the unpleasant duties of their profession, without however abating any of their claim to money or honour, they quickly fell away from the standard of the doctors of old. Methods of cooking, and all the preparation of food for the sick, they left to nurses; compounding of drugs they left to the apothecaries; manual operation to barbers. Thus in course of time the art of healing has been so wretchedly rent asunder, that certain doctors,[6] advertising themselves under the name of physicians,[7] have arrogated to themselves alone the prescription of drugs and diet for obscure diseases, and have relegated the rest of
2 medicine to those whom they call surgeons[8] ‖ and scarcely regard as slaves, disgracefully banishing from themselves the chief and most ancient branch of the medical art, and that which principally (if indeed there be any other) bases itself upon the investigation of nature. Yet among the Indians to-day it is the kings that chiefly exercise this [surgical] art; the Persians hand it down as an obligatory inheritance to their children, as formerly did the whole family of the Asclepiads; the Thracians, with many other nations, cultivate and honour it above other arts, to the neglect almost of that part of the art [the prescription of drugs], which formerly many proscribed from the state, as devised for the deception and destruction of men; for it, refusing the aid of nature gives no deep relief, but rather, endeavouring to help nature while it is in any case overwrought by the effort to cast off the disease, it often destroys it quite and utterly distracts it from its normal function. Consequently it is to it in particular we owe the fact that so many scoffs are wont to be cast at doctors, and this most holy art is made a mock, though all the time one part of it, which those trained in liberal studies allow basely to be torn from them, could adorn it for ever with peculiar praise.

For when Homer, that well-spring of genius, declares that a man that is a doctor is better than a host, and together with all the poets of Greece celebrates Podalyrius and Machaon, truly these divine sons of Aesculapius are thus praised not for the reason that they banished a touch of fever or other ailments which nature usually cures unaided, and without the assistance of the doctor more easily than with his aid, nor because they pandered to the appetites of men in obscure and desperate affections, but because they devoted themselves in particular to the cure of dislocations, fractures, bruises, wounds, and other breaches of continuity,[9] and to fluxions of blood, and because they freed the noble warriors of Agamemnon from javelins, darts, and other evils of that kind, which wars particularly occasion, and which always demand the careful attention of the doctor.

5 *Architectorum modo.*
6 *Medici.*
7 *Se physicorum nomine venditantes.*
8 *Quos chirurgos nominant.*
9 *Reliquarum continuitatis solutionum.*

But it was not at all my purpose to set one instrument of medicine above the rest, since the triple art of healing, as it is called, cannot at all be disunited and wrenched asunder, but belongs in its entirety to the same practitioner; and for the due attainment of this triple art, all the parts of medicine have been established and prepared on an equal footing, so that the individual parts are brought into use with a success proportioned to the degree in which one combines the cumulative force of all. How rarely indeed a disease occurs which does not at once require the triple manner of treatment: that is to say, a proper diet must be prescribed, some service must be rendered by medicine, and some by the hand. Therefore the tyros in this art must by every means be exhorted to follow the Greeks in despising the whisperings of those physicians (save the mark!), and, as the fundamental nature and rational basis of the art prescribes, to apply their hands also to the treatment, lest they should rend the body of medicine and make of it a force destructive of the common life of man.

And they must be urged to this with all the greater earnestness because men to-day who have had an irreproachable training in the art are seen to abstain from the use of the hand as from the plague, and for this very reason, lest they should be slandered by the Masters of the profession[10] as barbers before the ignorant mob, and should henceforth lack equal gain and honour with those less than half-doctors, losing their standing both with the uneducated commonalty and with princes. For it is indeed above all other things the wide prevalence of this hateful error that prevents us even in our age from taking up the healing art as a whole, makes us confine ourselves merely to the treatment of internal complaints, and, if I may utter the blunt truth once for all, causes us, to the great detriment of mankind, to study to be healers only in a very limited degree.

For when, in the first place, the whole compounding of drugs was handed over to the apothecaries, then the doctors promptly lost the knowledge of simple medicines which is absolutely essential to them; and they became responsible for the fact that the druggists' shops were filled with barbarous terms and false remedies, and also that so many elegant compositions of the ancients were lost to us, several of which have not yet come to light; and, finally, they prepared an endless task for the learned men, not only of our own age, but for those who preceded it by some years, who devoted themselves with indefatigable zeal to research in simple medicines; so much so that they may be regarded as having gone far to restore the knowledge of them to its former brilliance.

But this perverse distribution of the instruments of healing among a variety of craftsmen inflicted a much more odious shipwreck and a far more cruel blow upon the chief branch of natural philosophy [Anatomy], to which, since it comprises the natural history of man and should rightly be regarded as the firm foundation of the whole art of medicine and its essential preliminary, Hippocrates and Plato attached so much importance that they did not hesitate to put it first among the parts of medicine. For though originally it was the prime object of the doctors' care, and though they strained every nerve to acquire it, it finally began to perish miserably when the doctors themselves, by resigning manual operations to others, ruined Anatomy. For when the doctors supposed that only the care of internal complaints concerned them, considering a mere knowledge of the viscera as more than enough for them, they neglected the structure of the bones and muscles, as well as of the nerves, veins and arteries which run through bones and muscles, as of no importance for them. And further, when the whole conduct of manual operations was entrusted to barbers, not only did doctors lose the true knowledge of the viscera, but the
3 practice of dissection ▌ soon died out, doubtless for the reason that the doctors did not attempt to operate, while those to whom the manual skill was resigned were too ignorant to read the writings of the teachers of anatomy.

[10] *A medicorum Rabinis.*

It is thus utterly impossible for this class of men to preserve for us a difficult art which they have acquired only mechanically. And equally inevitably this deplorable dismemberment of the art of healing has introduced into our schools the detestable procedure now in vogue, that one man should carry out the dissection of the human body, and another give the description of the parts. These latter are perched up aloft in a pulpit like jackdaws, and with a notable air of disdain they drone out information about facts they have never approached at first hand, but which they merely commit to memory from the books of others, or of which they have descriptions before their eyes; the former are so ignorant of languages that they are unable to explain their dissections to the onlookers and botch what ought to be exhibited in accordance with the instruction of the physician, who never applies his hand to the dissection, and contemptuously steers the ship out of the manual, as the saying goes. Thus everything is wrongly taught, days are wasted in absurd questions, and in the confusion less is offered to the onlooker than a butcher in his stall could teach a doctor.[11] I omit all mention of those schools in which there is scarcely even a thought of opening a human body to exhibit its structure. So far had ancient medicine fallen some years ago from its pristine glory.

But when medicine in the great blessedness of this age, which the gods will to entrust to the wise guidance of your divine power, had, together with all studies, begun to live again and to lift its head up from its utter darkness (so much so, indeed, that it might without fear of contradiction be regarded in some academies as having well nigh recovered its ancient brilliance): and when there was nothing of which the need was now so urgently felt as the resurrection of the science of Anatomy, then I, challenged by the example of so many eminent men, in so far as I could and with what means I could command, thought I should lend my aid. And lest, when all others for the sake of our common studies were engaged in some attempt and with such great success, I alone should be idle, or lest I should fall below the level of my forebears, doctors to be sure not unknown to fame, I thought that this branch of natural philosophy should be recalled from the dead, so that if it did not achieve with us a greater perfection than at any other place or time among the old teachers of anatomy, it might at least reach such a point that one could with confidence assert that our modern science of anatomy was equal to that of old, and that in this age anatomy was unique both in the level to which it had sunk and in the completeness of its subsequent restoration.

But this effort could by no manner of means have succeeded, if, when I was studying medicine at Paris, I had not myself applied my hand to this business, but had acquiesced in the casual and superficial display to me and my fellow-students by certain barbers of a few organs at one or two public dissections. For in such a perfunctory manner was anatomy then treated in the place where we have lived to see medicine happily reborn, that I myself, having trained myself without guidance in the dissection of brute creatures, at the third dissection at which it was my fortune ever to be present (this, as was the custom there, was concerned exclusively or principally with the viscera), led on by the encouragement of my fellow-students and teachers, performed in public a more thorough dissection than was wont to be done. Later I attempted a second dissection, my purpose being to exhibit the muscles of the hand[12] together with a more accurate dissection of the viscera. For except for eight muscles of the abdomen, disgracefully mangled and in the wrong order, no one (I speak the simple truth) ever demonstrated to me any single muscle, or any single bone, much less the network of nerves, veins and arteries.

Subsequently at Louvain, where I had to return on account of the disturbance of war, because during eighteen years the doctors there had not even dreamed of

11 *Spectatoribus in illo tumultu pauciora proponuntur, quam lanius in macello medicum docere posset.*

12 cf. The woodcut portrait of Vesalius.

anatomy, and in order that I might help the students of that academy, and that I myself might acquire greater skill in a matter both obscure and in my judgment of prime importance for the whole of medicine, I did somewhat more accurately than at Paris expound the whole structure of the human body in the course of dissecting, with the result that the younger teachers[13] of that academy now appear to spend great and very serious study in acquiring a knowledge of the parts of man, clearly understanding what invaluable material for philosophizing is presented to them from this knowledge. Furthermore at Padua, in the most famous gymnasium of the whole world, I had been charged with the teaching of surgical medicine[14] five years by the Illustrious Senate of Venice, which is far the most liberal in the endowment of the higher branches of learning. And since the carrying out of anatomical enquiry is of importance for surgical medicine, I devoted much effort to the investigation of the structure of man, and so directed my enquiries, and, exploding the ridiculous fashion of the schools, so taught the subject, that we could not find in my procedure anything that fell short of the tradition of the ancients.

However, the supineness of the medical profession has seen to it only too well that the writings of Eudemus, Herophilus, Marinus, Andreas, Lycus, and other princes of anatomy should not be preserved to us, since not even a fragment of any page has survived of all those famous writers whom Galen mentions, to the number of more than twenty, in his second commentary to the book of Hippocrates on *The Nature of Man*. Nay, even of his own anatomical writings scarcely the half has been saved from destruction. But those who followed Galen, among whom I place Oribasius, Theophilus, the Arabs, and all our own writers whom I have read to date, all of them
4 (and they must pardon me for saying this) ‖, if they handed on anything worth reading, borrowed it from him. And, believe me, the careful reader will discover that there is nothing they were further from attempting than the dissection of bodies. They placed an absolute trust in I know not what quality of the writing of their chief, and in the neglect of dissection of the rest, and shamefully reduced Galen to convenient summaries, never departing from him by so much as the breadth of a nail, that is supposing they succeed in arriving at his meaning. Nay, they place it in the forefront of their books that their own writings are pieced together from the teachings of Galen, and that all that is theirs is his. And so completely have all surrendered to his authority, that no doctor has been found to declare that in the anatomical books of Galen even the slightest error has ever been found, much less could now be found; though all the time (apart from the fact that Galen frequently corrects himself, and in later books, after acquiring more experience, removes oversights that he had committed in earlier books, and sometimes teaches contradictory views) it is quite clear to us, from the revival of the art of dissection, from a painstaking perusal of the works of Galen, and from a restoration of them in several places, of which we have no reason to be ashamed, that Galen himself never dissected a human body lately dead. Nay more, deceived by his monkeys (although it is admitted that human bodies dried, and prepared as it were for an inspection of the bones, did come under his observation), he frequently wrongly controverts the ancient doctors who had trained themselves by dissecting human corpses.

And again, how many false observations you will find him to have made even on his monkeys. I shall say nothing about the astonishing fact that in the manifold and infinite divergences of the organs of the human body from those of the monkey Galen hardly noticed anything except in the fingers and the bend of the knee—which he would certainly have passed over with the rest, if they had not been obvious to him without dissection. But at the moment I do not propose to criticize

13 *Iuniores professores.*
14 *Medicinae Chirurgicae Professionem.*

the false statements of Galen, easily the foremost among the teachers of anatomy; and much less would I wish to be regarded now in the beginning as disloyal to the author of all good things and lacking in respect for his authority. For I am not unaware how the medical profession (in this so different from the followers of Aristotle) are wont to be upset when in more than two hundred instances, in the conduct of the single course of anatomy I now exhibit in the schools, they see that Galen has failed to give a true description of the inter-relation, use, and function of the parts of man—how they scowl at times, and examine every inch of the dissection in their determination to defend him. Yet they too, drawn by the love of truth, gradually abandon that attitude and, growing less emphatic, begin to put faith in their own not ineffectual sight and powers of reason rather than in the writings of Galen. These true paradoxes, won not by slavish reliance on the efforts of others, nor supported merely by masses of authorities, they eagerly communicate in their correspondence to their friends; they exhort them so earnestly and so friendly-wise to examine them for themselves, and to come at last to a true knowledge of anatomy, that there is ground for hope that anatomy will ere long be cultivated in all our academies as it was of old in Alexandria.

And that the Muses might the more smile upon this hope, I have, so far as in me lay, and in addition to my other publications on this subject—which certain plagiarists, thinking me far away from Germany, have put out there as their own—made a completely fresh arrangement in seven books of my information about the parts of the human body in the order in which I am wont to lay the same before that learned assembly in this city, as well as at Bologna, and at Pisa. Thus those present at the dissections will have a record of what was there demonstrated, and will be able to expound anatomy to others with less trouble. And also the books will be by no means useless to those who have no opportunity for personal examination, for they relate with sufficient fulness the number, position, shape, substance, connection with other parts, use and function of each part of the human body, together with many similar facts which we are wont to unravel during dissection concerning the nature of the parts, and also the method of dissection applicable to dead and living animals. Moreover, the books contain representations of all the parts inserted in the text of the discourse, in such a way that they place before the eyes of the student of Nature's works, as it were, a dissected corpse.

Thus in the First Book I have described the nature of all bones and cartilages, which, since the other parts are supported by them, and must be described in accordance with them, are the first to be known by students of anatomy. The Second Book treats of the ligaments by which the bones and cartilages are linked one with another, and then the muscles that affect the movements that depend upon our will. The Third comprises the close network of veins which carry to the muscles and bones and the other parts the ordinary blood[15] by which they are nourished, and of arteries which control the mixture of Innate Heat and Vital Spirit. The Fourth treats of the branches not only of the nerves which convey the Animal Spirit to the muscles, but of all the other nerves as well. The Fifth explains the structure of the organs that subserve nutrition effected through food and drink; and furthermore, on account of the proximity of their position, it contains also the instruments designed by the Most High Creator for the propagation of the species. The Sixth is devoted to the heart, the *fomes* of the vital faculty, and the parts that subserve it. The Seventh describes the harmony between the structure of the brain and the organs of sense, without, however, repeating from the fourth book the description of the network of nerves arising from the brain.

15 *Familiaris sanguis.*

Now in arranging the order of these books I have followed the opinion of Galen, who, after the account of the muscles, considered that the anatomy of the veins, arteries, nerves, and then of the viscera should be handled. But with very great reason it will be urged, and especially in the case of a beginner in this science, that the study of the viscera ought to be combined with that of the distribution of the vessels, a course I have followed in the *Epitome*. This latter I have made to be as it were a footpath beside the highway of the larger book, and an index of what is set forth in it;[16] and it is honoured with the splendid patronage of His Serene Highness Philip, Your Majesty's son, and a living embodiment of his father's virtues.

But here there comes into my mind the judgment of certain men who vehemently condemn the practice of setting before the eyes of students, as we do with the parts of plants, delineations, be they never so accurate, of the parts of the human body. These, they say, ought to be learned, not by pictures, but by careful dissection and examination of the things themselves. As if, forsooth, my object in adding to the text of my discourse images of the parts, which are most faithful, and which I wish could be free from the risk of being spoiled by the printers, was that students should rely upon them and refrain from dissecting bodies; whereas my practice has rather been to encourage students of medicine in every way I could to perform dissections with their own hands. Assuredly, if the practice of the ancients had lasted down to our day, namely, to train boys at home in carrying out dissections, just as in making their letters and in reading, I would gladly consent to our dispensing not only with pictures, but with all commentaries. For the ancients only began to write about dissection when they decided that honour demanded that they should communicate the art, not only to their children, but to strangers whom they respected for their virtue. For, as soon as boys were no longer trained in dissection, the inevitable consequence at once followed that they learned anatomy less well, since the training had been abolished with which they had been wont to begin in youth. So much so that when the art had deserted the family of the Asclepiads, and had been now for many centuries on the decline, books were needed to preserve a complete view of it. Yet how greatly pictures aid the understanding of these things, and how much more accurately they put the things before the eyes than even the clearest language, nobody can have failed to experience in geometry and the other mathematical disciplines.

But, however that may be, I have done my best to this single end, namely, in an equally recondite and laborious matter, to aid as many as possible, and truly and completely to describe the structure of the human body—which is built up, not of some ten or twelve parts (as seems to those who give it a passing glance), but of some thousands of different parts—and to bring to students of medicine a substantial contribution towards the understanding of those books of Galen treating of this branch of learning, which of all his writings most require the assistance of a teacher. Moreover I am aware [first] how little authority my efforts will carry by reason of my youth (I am still in my twenty-eighth year); and [secondly] how little, on account of the frequency with which I draw attention to the falsity of Galen's pronouncements, I shall be sheltered from the attacks of those who have not—as I have done in the schools of Italy—applied themselves earnestly to anatomy, and who, being now old men devoured by envy at the true discoveries of youths, will be ashamed, together with all the other sectaries of Galen, that they have been hitherto so purblind failing to notice what I now set forth, yet arrogating to themselves a mighty reputation in the art—[I know, I say, how little authority my

16 *Quam veluti horum librorum semitam, ac in illis demonstratorum indicem praeparavi.*

efforts will carry] unless they come forth auspiciously into the light, commended by the great patronage of some divine power. And, in as much as it cannot be more safely sheltered or more splendidly adorned than by the imperishable name of The Divine Charles, The Most Great and Invincible Emperor, I beseech Your Majesty to allow this useful work of mine, which on many accounts and for many reasons is dangerous to itself, to circulate for a short time under Your Majesty's auspices, glory, and patronage, until through experience of the facts, through judgment which matures with time, and through learning, I may make the fruit of my toil worthy of The Most High and Best Prince, or may offer another gift worthy of acceptance on another subject chosen from our art.

And yet I am of opinion that out of the whole Apolline discipline, and indeed out of the whole philosophy of nature, nothing could be fashioned more pleasing or more acceptable to Your Majesty than an account from which we learn of the body and of the mind, and furthermore of a certain divine power consisting of the harmony of both, in sum, of ourselves, whom to know is man's proper study. And, though I infer this from many arguments, yet my principal reason is that in the multitude of books dedicated to your grandfather of blessed memory, Maximillian, the Roman, The Most Great Emperor, none was ever more pleasing than a little book which dealt with the present matter. Nor shall I ever forget with what pleasure you examined my anatomical figures, and how carefully you enquired about every point, when my father Andreas, the first and most faithful of Your Majesty's physicians, once offered them for your inspection. I say nothing now of that love of yours passing belief for all sciences in general, but chiefly for mathematics, and especially for that branch of it that deals with the universe and the stars, and of your skill in it, which is wonderful in so great and heroic a man. So great is this that it can hardly be but that as you are attracted in an unique degree by the science of the universe, so also you should at times delight in considering the most perfectly constructed among all created things, and should take pleasure in considering what is the temporary dwelling-place and instrument of the immortal soul. For this in many particulars exhibits a marvellous correspondence with the universe, and for that reason was by them of old not inappropriately styled "a little universe."[17]

But just as I said a moment ago that I did not at all regard this as the proper place for glorifying a knowledge of the human body, worthy as it is of the attention of man, and in itself to be commended above all others, being a study moreover to which even at Rome men outstanding not only in their material circumstances but in philosophical training delighted to apply themselves; so also, bearing well in mind the wish of Alexander the Great who would have himself painted by none but Apelles, cast in bronze only by Lysippus, nor carved by any but Pyrgoteles, I have thought it still less fitting for me to attempt any estimate of your glories, lest by my bald and unpractised style I might obscure rather than illuminate them. Especially since we ought assuredly to condemn the formality too frequently admitted in prefatory addresses, in which with complete lack of discrimination and, as a rule, to a degree far surpassing the deserts of him to whom they are addressed, as if in accordance with a stereotyped formula, and merely for the sake of securing some cheap reward, there are ascribed to everybody a degree of learning to which we must look up, unexampled prudence, wonderful clemency, keen judgment, indefatigable generosity, wonderful love of men of letters and of learning, ripe despatch in the conduct of affairs, in fine the whole galaxy of virtues. But that Your Majesty excels all men everywhere in them, no less than in dignity of rank, in prosperity, and in the success of your exploits, even though it be proclaimed not here by me, is patent to

17 *Microcosmus.*

the understanding of all. Wherefore while you yet live you are venerated as an exalted divinity. And my prayer is that the Gods should not grudge this happy lot to learning and the whole world, but should long guard and preserve it for mankind in security and in uninterrupted blessedness.

Padua, August 1, A.D. 1542.

Section of Medicine.

President—Dr. H. Morley Fletcher, M.D.

[*April* 26, 1932.]

Experimental and Clinical Investigations on the Respiratory Changes of Blood-pressure.

By Dr. Adolf Schott

(*Bad Nauheim and Frankfurt-am-Main*).

The respiratory changes of blood-pressure in man, known clinically as "pulsus paradoxus," consist in a decrease of the amplitude of the pulse during inspiration and in an increase during expiration. According to Wenckebach, there are three forms of pulsus paradoxus which, by means of a detailed analysis of the tracings, can be recognized and diagnosed by determining the exact relationship between the respiratory phase and the occurrence of the pulse waves of different heights. These three kinds are: (1) The extrathoracic form of pulsus paradoxus. In these—comparatively rare—cases the pulsus paradoxus is caused by an abnormal course of the subclavian artery which, during inspiration, is compressed between the first rib and the clavicle. Naturally, this kind of pulsus paradoxus is without any clinical significance. It is only necessary to know about it in order to distinguish it from the two other kinds. (2) The mechanical form of pulsus paradoxus. In these cases the pulsus paradoxus is caused by adhesions between the heart and its surroundings; this form is pathognomonic for the adhesive mediastino-pericarditis. (3) The dynamic form of pulsus paradoxus. Here, the pulsus paradoxus is caused entirely by the respiratory variations of intrathoracic pressure. This third form only is the subject of the present paper.

Among the conditions causing the phenomenon of a dynamic pulsus paradoxus, prominent authors, such as Wenckebach and Winterberg, mention weakness and atonia of the heart-muscle as well as considerable dilatation of the heart. On the other hand, it is known that the respiratory changes of the normal pulse may be registered graphically if, by means of a cuff, the arm is compressed by a pressure of about 10 mm. Hg below systolic blood-pressure (*see* Rist and Walser, Fischer and Schur). It seemed reasonable to hope, therefore, that the phenomenon of the dynamic pulsus paradoxus could be used for diagnosing incipient or latent weakness of the heart-muscle along the following lines: If, in healthy people, the respiratory changes of the pulse amplitude appear only if a pressure of about 10 mm. Hg below systolic blood-pressure is applied to the arm, and if, on the other hand, in people suffering from advanced weakness of the heart-muscle, these respiratory changes are present without any compression at all, intermediate stages of incipient weakness of the heart-muscle must exist where pulsus paradoxus may appear if a compression lower than 10 mm. Hg below systolic blood-pressure is used. A pulsus paradoxus appearing under these conditions would represent a help for diagnosing latent or incipient weakness or atonia of the heart-muscle.

I tried this in quite a number of cases, but soon became convinced that the plan was not feasible, as I could not confirm the statement, quoted above, that weakness or atonia of the heart-muscle, or considerable dilatation of the heart, leads to the appearance of a pulsus paradoxus.

Therefore I proceeded to carry out experiments on dogs, to see whether an increase of the normal respiratory changes of blood-pressure ensues if a weakness of the heart-muscle is produced experimentally. I found that no increase of the respiratory changes of blood-pressure could be caused by lowering the contractile power of the heart-muscle by means of intravenous injections of quinine or chloride of potassium, even if a considerable fall in blood-pressure took place. In these experiments the pulse was registered directly by means of an optical manometer.

As, in taking pulse tracings in man, we use indirect methods of registration, I then made comparative studies of the results of direct and indirect pulse registration. In dogs anæsthetized by somnifen, the pulse of one carotid artery was registered

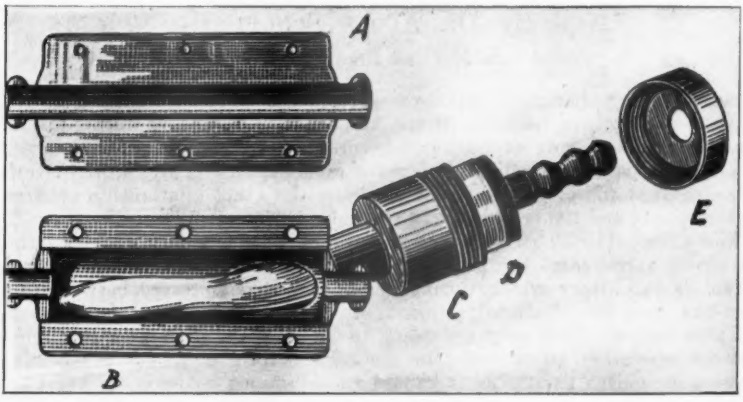


FIG. 1.—Capsule for registering carotid pulse under various compressing pressures and without opening the vessel. A, plate with shallow grove on which the artery is placed. B, arched cover which is screwed on to the plate. In its interior a thin finger-stall which communicates through D with the registering capsule, pump and monometer. E and C, fastening screws.

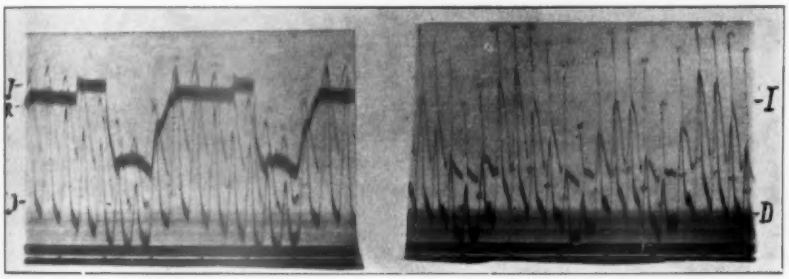
directly by inserting into the artery a cannula which was connected with an optical manometer. The pulse of the other carotid artery was registered indirectly without opening the vessel and this under various compressions the pressure of which was known and could be varied at will. This was effected by means of a special capsule (fig. 1), by which the changes of volume of 5 cm. of the carotid artery were transferred to a thin finger-stall, which could be inflated and compressed the artery with various and known pressures; the changes of pressure which took place in the finger-stall during each pulse were registered optically by means of a differential capsule on the same film as were the pressure of the other carotid and the respiratory tracing.

These investigations yielded the result that, with regard to the respiratory changes of pulse amplitude, there is no parallel between the result of direct and indirect registration and that, by indirect registration, the degree of the respiratory changes of pulse amplitude depends on the relation between compressing pressure and systolic pressure; the respiratory changes thus inscribed attain their maxima if the

compressing pressure is about 10 mm. Hg below systolic pressure. (A second maximum lies in the neighbourhood of diastolic pressure.).

A clear illustration of this is to be seen in fig. 2, which shows that, in consequence of the injection of 0·5 c.c. of 20% solution of quinine, the respiratory changes of pulse amplitude, if registered directly, are decreased from 40 to 32 mm., whereas by indirect registration they increase by more than 100%, from 15 to 36 mm. Analogous results are shown in fig. 3, where a great rise in the respiratory changes of pulse amplitude—a "pulsus paradoxus"—was obtained by adjusting the compressing pressure at a level just below systolic pressure. Similar results were also seen in the experiments carried out with potassium chloride.

An additional proof is the effect of bleeding on the tracing. The withdrawal of a small amount of blood, e.g. 80 c.c. in a dog of 12 kg., leads to a temporary appearance of a pulsus paradoxus. This can only be explained by the well-known fact that withdrawal of small amounts of blood leads to a transitory fall of blood-pressure, while it does not affect the heart itself; if the blood-pressure falls to a level



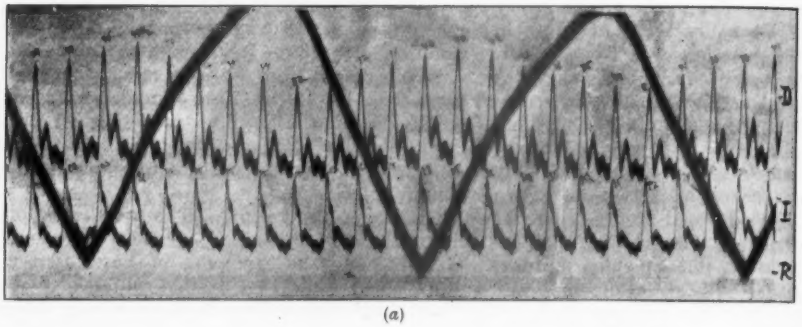
(*a*) (*b*)

FIG. 2.—Direct and indirect tracings of pulse, and tracing of respiration. D = direct. I = indirect. R = respiration (downstroke = inspiration). (*a*) Before quinine. Respiratory changes of pulse amplitude by direct registration 40 mm., by indirect registration 15 mm. (*b*) After 0·5 c.c. 20% quinine. Respiratory changes of pulse amplitude by direct registration 32 mm. (decrease by 8 mm.), by indirect registration 36 mm. (increase by 16 mm.).

just above the compressing pressure, the respiratory changes of blood-pressure, thus inscribed, are markedly increased, while the tracing of direct registration does not show any change.

Clinical observations are in accordance with the results of the experiments described. I took optical tracings of the pulse of the brachial artery under various and known compressing pressures in combination with tracings of the respiration. This was done in thirty-six cases of heart disease, and in twenty-six cases without any cardiovascular disturbance, or with only secondary and unimportant involvement of the circulation. I also registered the compressing pressure on the same film by means of an optical glass-plate manometer (Broemser), thus making sure that the compressing pressure remained constant during each phase of registration, and being able thereby to measure the pressure, not only during the registration, but also afterwards, as the manometer was standardized.

The result of these investigations was that in patients suffering from marked cardiac failure, weakness of the heart-muscle, and considerable dilatation of the



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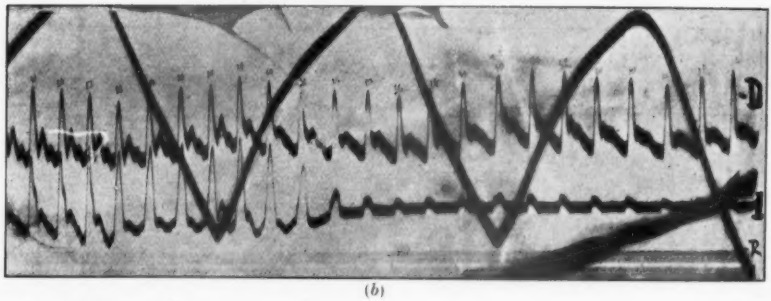

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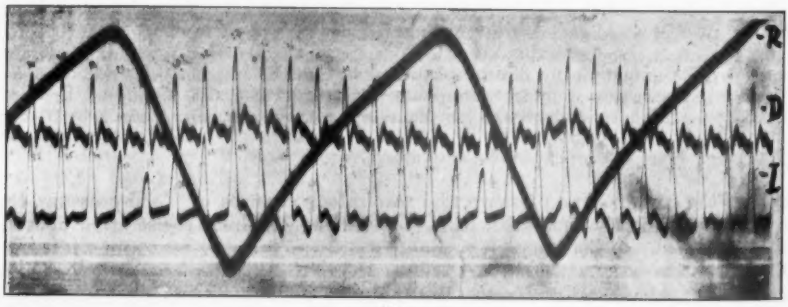


(*c*)

FIG. 3.—Cf. legend for fig. 2. (*a*) Before quinine. Respiratory changes of pulse amplitude by direct registration 10 mm., by indirect registration 4 mm. (*b*) After 2 c.c. 20% quinine. Respiratory changes of pulse amplitude by direct registration 10 mm. (unchanged), by indirect registration no pulse tracing, as the blood-pressure had become lower than the compressing pressure. (*c*) 1 to 2 minutes afterwards. Respiratory changes of pulse amplitude by direct registration remained unchanged (11 mm.), indirect registration shows marked "pulsus paradoxus" (25 mm.) in consequence of the fact that the compressing pressure had been adjusted at a level just below systolic pressure.

heart, a pulsus paradoxus was usually absent (figs. 4 and 5). Especially in cases showing congestion of the lungs a pulsus paradoxus could not even be discovered if the arm was compressed with a pressure just below systolic pressure, whereas

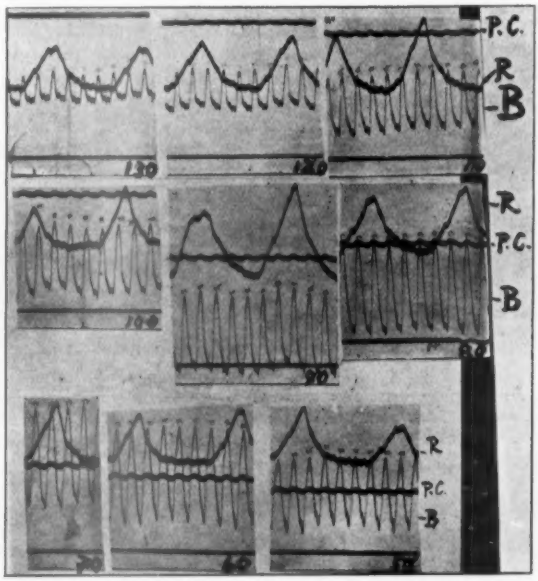


FIG. 4.—Brachial pulse (B), respiration (R) and compressing pressure (P.C.) in a case of luetic aortic incompetence with advanced general circulatory failure. The figures in the right lower corner of each part of the tracing are the compressing pressures in mm. Hg. The lower horizontal line is the zero line of the glass plate manometer which registers the compressing pressure. Respiration: upstroke = inspiration. No pulsus paradoxus.

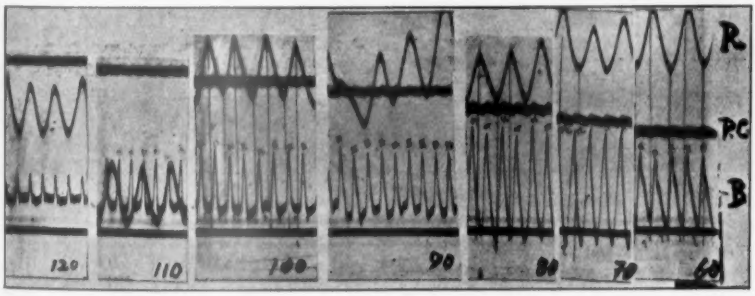


FIG. 5.—Cf. legend for fig. 4. Case of active endocarditis with advanced general circulatory failure. No pulsus paradoxus.

normal cases usually showed this phenomenon quite clearly. This may be easily understood if one recalls Tigerstedt's investigations on animals, by which he showed that the respiratory changes of blood-pressure disappear if the arterial resistance is

increased to a marked extent. In either condition a superabundant quantity of blood is offered to the left auricle, and in spite of respiratory variations of filling, the left ventricle always discharges the maximal amount of blood which it can expel.

The pulsus paradoxus over a range of compressing pressures wider than normal was very marked in cases of emphysema of the lungs (fig. 6). Even when no material dyspnœa was present the respiratory changes of the pulse amplitude were considerable (fig. 7). The same was observed in cases of unilateral pneumothorax (fig. 8). Taking into consideration the results of recent research work in connection with the physiology of respiration, this result may be explained by the fact that in

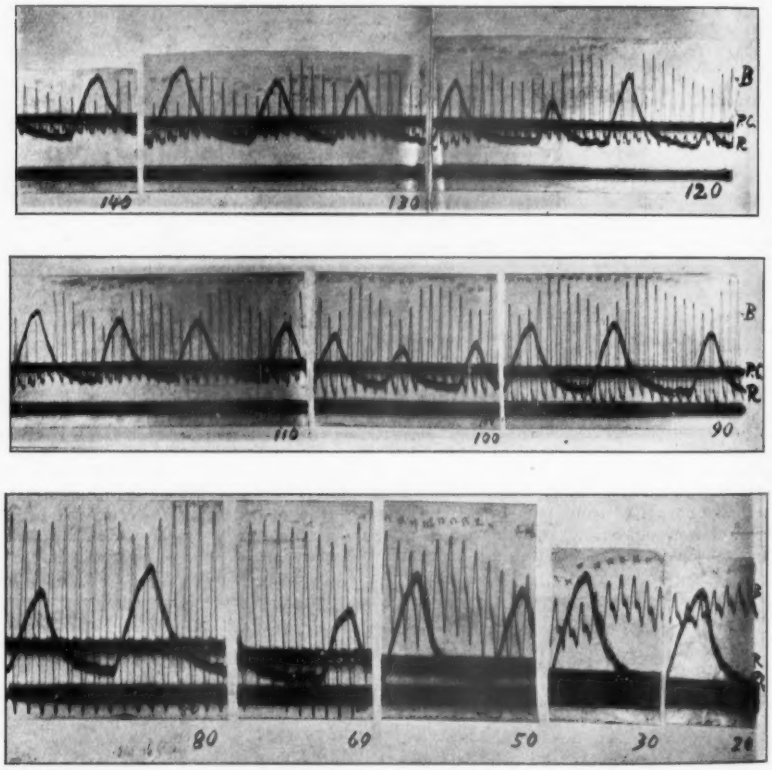


FIG. 6.—Cf. legend for fig. 4. Case of emphysema of the lungs with chronic bronchitis. Marked pulsus paradoxus over a wide range of compressing pressures.

cases of emphysema of the lungs and of pneumothorax the intra-alveolar respiratory changes of pressure are increased, in consequence of the increased resistance in the bronchial and bronchiolar tubes, and that these increased respiratory changes of intra-alveolar pressure act on the pulmonary blood-vessels, whose resistance is also increased. This conception helps also to an understanding of the fact that heart cases suffering from congestion of the lungs do not show the pulsus paradoxus.

The practical conclusion to be drawn from these observations is that the occurrence of a dynamic pulsus paradoxus may be indicative of increased resistance

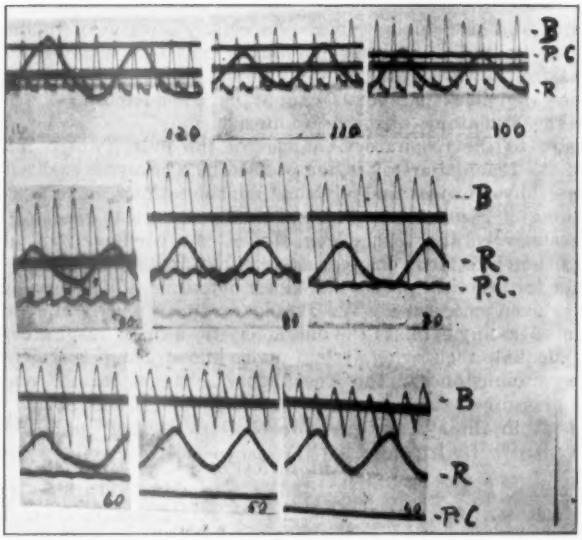
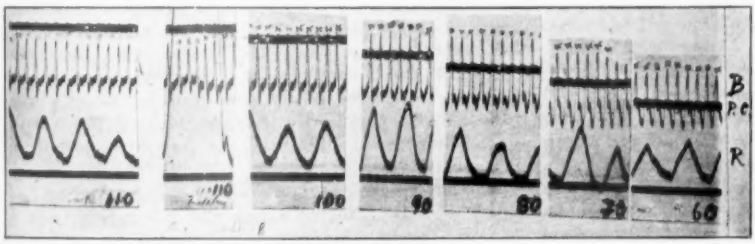


FIG. 7.—Cf. legend for fig. 4. Case of very slight emphysema of the lungs without dyspnœa. Marked pulsus paradoxus over a considerable range of compressing pressures.



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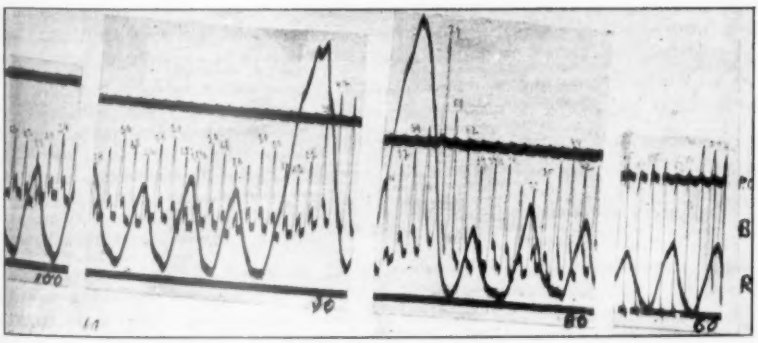

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FIG. 8.—Cf. legend for fig. 4. (*a*) Before pneumothorax. No pulsus paradoxus. (*b*) After the first unilateral pneumothorax of 400 c.c. Pulsus paradoxus over a considerable range of compressing pressures.

in the bronchial and bronchiolar tubes. Especially in cases of incipient emphysema of the lungs the finding of a pulsus paradoxus may be a diagnostic help. I should like to emphasize, however, that in my opinion, which, in this point, is contrary to that of others—a pulsus paradoxus cannot be considered a sign of imminent or incipient weakness or atonia of the heart-muscle.

With regard to the respiratory changes of the pulse, which may be registered graphically if the brachial artery is compressed by a pressure just below the systolic blood-pressure, physiological and physical considerations make it clear that under those conditions of registration the respiratory changes in the height of the pulse waves are exclusively due to the changes of the coefficient of elasticity of the arterial wall; therefore those changes are without any clinical importance. I think, moreover, that for practical purposes a closer definition of dynamic pulsus paradoxus is advisable or even necessary. We should diagnose a dynamic pulsus paradoxus only if the pulse tracing exhibits the characteristic form of respiratory changes when taken by an adequate registering system under known compressing pressures, and if, under these circumstances, the respiratory changes occur over a range of compressing pressures which exceeds the range in normal people. This normal range extends from the systolic pressure to from 10 to 15 mm. Hg below it.

BIBLIOGRAPHY.

BROEMSER, *Zeitschrift f. Biologie*, 1920, lxxi, 281. FISCHER und SCHUR, *Wiener Archiv f. Innere Medizin*, 1929, xviii, 151. RIST und WALSER, *Annales de Médecine*, 1925, xvii, 307. TIGERSTEDT, "Ergebnisse der Physiologie, 1903," ii-2, 528; "Lehrbuch der Physiologie des Kreislaufs, 1923," iv, 44. WENCKEBACH, *Zeitschrift f. klinische Medizin*, 1910, lxxi, 402. WENCKEBACH und WINTERBERG, "Die unregelmässige Herztätigkeit," 1927, 578.

Section of Obstetrics and Gynæcology.

President—Mr. VICTOR BONNEY, F.R.C.S.

[*April* 15, 1932.]

Tubal Gestation as seen by the Gynæcologist: An Analytical Study of Certain Aspects, Clinical and Pathological, of a Consecutive Series of 146 cases.

By H. LEITH MURRAY, M.D.

I HAVE been careful in the title of this paper to define the type of tubal gestation I propose to analyse as that seen by the gynæcologist. The experience of the general surgeon differs from ours; he sees, as a rule, that type of urgent abdominal crisis with shock and collapse which is sent to him as an emergency by the practitioner in attendance, very often with no diagnosis other than "acute abdomen." His attitude towards the case is a reasonable one, usually an exploratory laparotomy; the history is short; there may be nothing abnormal to be felt in the pelvis, and the main symptom may be collapse of varying degree. But it is only natural that he should miss some of the finer points of clinical and pathological diagnosis.

I have seen, in all, 151 cases of proved tubal gestation. Five of these were operated on by others and the diagnosis was confirmed; I do not include them in any of the analyses I am about to give. In the 146 cases operated on by myself there have been no ovarian pregnancies, no advanced cases, no bilateral tubal pregnancies, no interstitial or cornual pregnancies, no cases suggesting external or internal migration of the ovum, no cases with obvious tubal abnormality or stretching of the tube over a new growth, and no hydatidiform changes in the ovum. I have, in fact, seen few unusual or complicated cases, and these I may mention now.

(1) Lithopædion weighing 3½ ounces, removed from a woman aged 34 who could give no history suggesting the time at which rupture or extrusion occurred; the symptoms were rectal pain and menorrhagia; one child 13 years previously.

(2) A case of combined intra- and extra-uterine pregnancy [1].

(3) A case complicated by small (duck's egg) bilateral dermoid cysts with adhesions in the pelvis and patent tubes anatomically unaffected by the tumours.

(4) A case associated with acutely necrobiotic fibroids, the tubes being patent and anatomically unaffected by the tumours.

There were only four desperate emergencies in the whole series, and in none of them was there any evidence of primary intra-peritoneal rupture. Two showed secondary intra-peritoneal rupture following attempted extrusion of a mole. A third was a case of straightforward ampullar gestation with profuse bleeding; this case was so definitely one of attempted extrusion through the fimbriated end that I have ever since been meticulously careful in my observation and treatment of tubal

gestation. The fourth was a secondary intra-ligamentary rupture, with shock out of all proportion to the amount of blood extruded.

Rather more than half the cases come under the description of "moderately serious," usually with somewhat prolonged histories of pain and bleeding, and, at the least, considerable invalidism. Most commonly these were cases which had been incorrectly treated by the practitioner, on a diagnosis of pelvic inflammation.

At the other end of the scale I find two cases in which the patient's first statement of complaint was sterility. It is remarkable that these women, with a considerable amount of clot in the pelvis, should have given, to begin with, so little indication of serious trouble. When one took their histories it became obvious that recent discomfort was the immediate occasion of their coming for advice. One of these patients was a lady doctor who had made thirty-five visits on the day she came to see me. Each of them had an isthmial pregnancy—a variety which I regard as most dangerous—and in each a mole was in process of extrusion.

It must be emphasized, therefore, that some cases of tubal gestation have relatively slight symptoms, yet with potentialities of danger which must not be overlooked. If I describe my experience of tubal gestation as having been, in general, rather placid, I shall not be far wrong. At the same time I feel that diagnosis and operation in these cases may have saved not only emergency but a prolonged convalescence. I always operate on diagnosis because I distrust tubal gestation. Until I can operate I insist on keeping every case so diagnosed under close observation.

In the ordinary run of cases diagnosis should be easy. I teach my students to suspect tubal gestation in all cases with a short history suggesting pregnancy and with pain out of proportion to that found in cases of early abortion. Interrogation on these lines usually suggests the diagnosis, and examination will be merely confirmatory. I confess that, on two occasions, I have opened an abdomen for presumed tubal gestation, to find nothing more than inspissated fæces in the lower bowel and evidence, later, of intra-uterine pregnancy in process of abortion. On four occasions I have operated for a condition that proved to be an acute exacerbation of old appendage disease with peritoneal shock from leakage and in one instance for suppurative salpingitis complicated by an abortion presumably criminally induced. On the other hand I have kept sixteen cases of possible tubal gestation under observation for days and found no need for operation; in not a single one of these have I any definite evidence of the real condition; I can only say that they *may* have been of that nature.

I do not propose to detail more than a few of the features of my cases. I wish to mention certain data, largely disconnected, which interest me *per se*, or which tempt me to disagree with the bulk of published opinion. My data are not so complete in all cases as I would wish, yet as I dictate my own operation notes and always study and report on my own specimens, I believe that I may have enough material for my purpose.

Mortality.—In two of my 146 cases the patients died. Both of these were cases with a long history as the result of misdiagnosis, with obvious anæmia and with considerable intra-peritonal bleeding. One patient died from pulmonary embolism on the eighth day, and the other from septic pneumonia associated with a pelvic abscess which followed operation.

Incidence.—The cases occurred in every month of the year, the months of lowest incidence being February, March, and September with ten each, and the highest July with fifteen. I expect that all will agree that tubal gestation appears to have a "pseudo-epidemic" tendency. On two separate occasions I have operated on a couple of tubal gestations on the same day and on one occasion I had five operative cases under my care at the same time. Although clinically there may appear to be a tendency towards groups of cases, the important point, of course, is not the date

when seen or operated on but the actual date of onset of symptoms. In the series there were fifteen instances in which two or three tubal gestations commenced their symptoms within ten days of each other. I have heard medical officers of sanatoria state that they were able to judge of the likelihood of pulmonary hæmorrhage by observation of the weather. No doubt, as Sir Leonard Hill has pointed out, there are various factors in such a prognosis, including stillness of the air. I thought it might be of interest to obtain information in regard to barometric readings round about those fifteen separate periods. Dr. A. T. Doodson, Associate Director of the Liverpool Observatory and Tidal Institute, Birkenhead, was good enough to give me full barometric readings round these dates. His summary is as follows: "We have extracted data for the barometer for fifteen days prior to the latest date in each period. There is nothing abnormal in any one and I doubt whether there is any other meteorological variable that can have any influence." In view of Dr. Doodson's report, I did not feel it worth while to proceed any further along this line and I accept the conclusion that any apparent epidemic tendency is merely coincidence without real significance.

Age.—The average age of the patients was 30·5 years—the youngest being aged 20 and the oldest a woman one year married, aged 42, and pregnant for the first time.

Side.—There were eighty-four cases in the right tube and sixty-two in the left tube. Larger statistics [2] do not seem to confirm to noticeable extent a tendency to more frequent affection of the right side.

Site.—One hundred and three cases (70·5%) were definitely ampullar, presumably primarily so. Forty cases were definitely isthmial; one case, while apparently ampullar, showed decidual changes in the isthmus and so must be classed isthmial. The site was undetermined in two cases owing to mutilation of the specimen during operative removal and one case showed a lithopædion 2¼ in. long in the pouch of Douglas.

Terminations of tubal gestation.—The possibilities include spontaneous cure, rupture, or continued growth. I have met no case of the last and confine my observations to the other possibilities.

A. Spontaneous cure.—Probably many cases of tubal gestation tend towards spontaneous cure by extrusion, and occasionally by absorption *in situ*. Yet I doubt whether by history or examination one can tell that one or other is a likely outcome. The closest observation, therefore, is advisable from the moment of diagnosis. In my personal view operation in every case diagnosed as tubal gestation is the better course, leading to immediate relief of symptoms and a rapid convalescence.

(1) *Extrusion.*—Of the 103 ampullar cases, 53 (50%) were almost extruded or appeared likely to be; but I cannot gauge the chances of serious bleeding that might have occurred before complete extrusion took place. As already mentioned one case of ampullar abortion was associated with most serious emergency. In the remaining 50 the lines of force tended definitely towards the fimbriated end of the tube, but there was, so to speak, a "long way to go" and some degree of obliquity. Of the 40 isthmial cases, 15 bulged outwards and sideways, and the chances of extrusion into the lumen of the tube seemed slight. All isthmial cases are dangerous but those that bulge laterally are probably more so. The factor of danger is the maintained vitality of some of the villi and the chance of secondary intra-peritoneal hæmorrhage from continued growth.

It must be remembered that villi may maintain a semblance of vitality, as judged by staining reactions, as the result of fixation by blood serum [3]. I have seen dead villi preserve staining for as long as fourteen days after vascular continuity had undoubtedly ceased. It is not easy, therefore, by ordinary histological examination to decide whether an ovum is completely dead—in

other words, whether the case still had potentialities of serious danger at the time of operation. No doubt in the future the Zondek-Ascheim test will be helpful, not merely for diagnostic but for prognostic purposes ; I have no experience of it.

(2) *Absorption* in situ.—I have histological evidence in one case alone; intra-peritoneal clot was very small in amount and the nodule in the isthmus showing dead villi was no larger than a lentil ; I operated for recurring pain but I do not know why this patient had so much. I require histological evidence rather than pious opinion [4] before I can believe that absorption *in situ* is common.

B. Rupture.—I am in the habit of dealing with this termination under the headings of : (1) Primary intra-tubal rupture (abortion or mole); (2) primary extra-tubal rupture (intra-peritoneal or intra-ligamentary) ; (3) secondary extra-tubal rupture (intra-peritoneal or intra-ligamentary).

(1) *Primary intra-tubal rupture* (*abortion or mole*).—Of the former I have seen eleven cases with the fœtus varying between one-quarter of an inch and one inch and a half long. No case had a shorter history of symptoms than seven days. To the latter group I am confident that 124 cases belonged.

In other words 92% of my cases showed primary intra-tubal rupture without further complication. This estimate differs greatly from many published statistics, yet I think I can bring good evidence in favour of it. In eight of these cases, all ampullar but not necessarily infundibular, there might have been some doubt as regards peritoneal rupture. They were all cases with a relatively long history of pain or pain and bleeding (from 4 to 14 weeks). In none was there any serious emergency at the time of operation but in each a fracture (as I will call it) of the peritoneal coat was visible. Now, if this tear occurred shortly before operation, a considerable degree of emergency might have been expected. On the other hand if it occurred earlier in the illness, there should have been found evidence of reparative reaction around its margin. The great majority of tubal gestations of any standing show most definite reparative round-celled deposit. I have even heard it suggested on more than one occasion that a particular case showing round-celled deposit was on the way to suppuration. But suppuration in tubal pregnancy is really a rarity and patchy round-celled deposit does not indicate any tendency in that direction. Round-celled deposit at the area of disturbance varies directly with the duration of symptoms and with the lack of good nuclear staining. Of 94 cases of which I have sufficient particulars, there was evidence of considerable round-celled deposit in 71 and none in 23 ; some of the latter were obviously associated with early operation and, no doubt, others may have been due to an unfortunately chosen section. The edges of an intra-peritoneal rupture of some duration could not fail to show particular evidence of such a process. In five of the eight cases which I have mentioned careful microscopical examination was made for evidence one way or another ; in none was there any particular deposit at the site of the tear. The other three cases unfortunately occurred rather early in the series and were not examined from this aspect. In none of the eight was there any bulk of fresh blood mingled with old clot near the tear. I deduce, therefore, that fracture in all eight cases was an artefact produced by operative removal. I hope that any who doubt this conclusion will devote more attention to the histological evidence at the site of so-called rupture.

(2) *Primary extra-tubal rupture.*—Not a single case in the whole series was of this nature. I doubt whether primary intra-peritoneal rupture of the usual kind of tubal gestation occurs often. The general surgeon who sees the bulk of acute emergency in tubal gestation is little likely, as I have said before, to appreciate the subtleties of the earlier history. My four cases of serious

emergency were certainly not of this nature. Fluid blood does not necessarily indicate recently effused blood. In twenty-four cases the blood within the abdomen was completely fluid, and in eight of these the history of pain had lasted for a week or more. I imagine that the factor of clotting depends on the rate of effusion plus the reaction of the peritoneum; it was obvious in a good many of the cases in which clotting did not occur that the blood was diluted.

(3) *Secondary extra-tubal rupture.*—(*a*) Intraperitoneal. Only six cases were definitely of this nature and all of them, be it noted, isthmial. As I wish to emphasize my view that intra-peritoneal rupture is an uncommon condition and, when it occurs, usually secondary in character, I propose to detail these six cases. In each, if the blood from attempted tubal abortion had not been clotted, the case, apart from its history, might readily have suggested primary rupture.

I.—(No. 33): Very obvious isthmial rupture with fœtus weighing 3½ oz. free in abdomen; placenta still within an enormously distended tube; copious fluid blood in lower abdomen, but less emergency than one would have expected; small black clot attached to fimbriated end of tube; history of "abortion" ten weeks previously for which the presence of a doctor was not deemed necessary.

II.—(No. 34): History suggesting tubal mole for three and a half weeks; a holiday in Paris spoilt by moderate pain and bleeding; she returned home feeling much better; but developed acute emergency after coitus and had to be operated on forthwith; the abdomen was full of fluid red blood; an isthmial rupture was obvious, but the pelvis contained old black clot.

III.—(No. 45): Small isthmial rupture with a history of twenty-two days' illness and recent exacerbation; the appendage was very readily delivered and the rupture was certainly not an artefact; moderate round-celled deposit was general in the area, but *not* specially around the rupture, which I consider a recent one; fluid red blood in lower abdomen; one small mass of old clot in pouch of Douglas. (Although this case occurred early in the series the specimen fortunately was kept and histological examination of the edge of the rupture carried out some years later.)

IV.—(No. 61): An undoubted isthmial mole with old black blood in the tube towards the fimbriated end of the tube and also beyond it; some recent clot in the region of a small isthmial rupture; history of thirteen days severe and recurring pain with bleeding; recent exacerbation of symptoms; unfortunately no sections were made.

V.—(No. 120): Isthmial rupture with a history of four weeks of recurring pain with bleeding; old black clot in pelvis and recent fluid blood in lower abdomen; symptoms moderately severe; round-celled deposit well marked throughout the area, but not specially round the rupture.

VI.—(No. 133): History of six weeks; in other respects similar to No. 5.

These six cases represent, I believe, the only intra-peritoneal ruptures that I have come across and they are all highly suggestive of secondary rupture. The features as detailed, coupled with the ease with which a laceration of the peritoneum can be produced during removal, confirm my view that secondary intra-peritoneal rupture is an occurrence of relative infrequency, and that primary intra-peritoneal rupture, of which I have no personal experience, is likely to be much less frequent than is commonly thought. General surgeons must help us towards a final solution of this question along the lines of history and histological examination that I have indicated.

(*b*) Intra-ligamentary. I have only met two cases of this complication, both originally isthmial. Unfortunately I have no details in either of the distribution of round-celled deposit in the area of rupture. One patient had a history of six weeks' upset followed by acute emergency with shock and collapse; she was, in fact, one of the most desperate of the whole series; old black clot was found in the pouch of Douglas and so much blood-clot within the broad ligament that the fundus of the uterus was visible, like the toe of a boot, as a projection on the thin abdominal wall.

The second case also had a history of six weeks; the intra-ligamentary hæmatoma was moderate in size; definite old clot was removed from the pouch of Douglas.

The above analysis accounts for 123 of my cases. Of the remaining three, two were so mutilated during removal that no conclusion was possible, either as regards origin or development, and the third case was the example of lithopædion already mentioned.

Summary in Relation to Terminations of Tubal Pregnancy.

I have good reason for asserting that in none of my 146 cases was there clear and indisputable evidence of primary intra-peritoneal rupture. 92% were obviously tubal moles or abortions and 5·4% secondary extra-tubal ruptures. Five of eight doubtful cases gave histological evidence that laceration of the peritoneal covering of the tube was an artefact.

As regards spontaneous cure, there seems a reasonable probability that it may occur frequently. I have evidence in one case alone of absorption *in situ*.

Ætiology of Tubal Pregnancy.

Recent textbooks seem to be giving up the idea of salpingitis as a frequent cause of tubal pregnancy. I note in the fourth edition of one manual on "Diseases of Women" [5] that "it must be admitted that we are ignorant of the cause or causes of extra-uterine pregnancy, in spite of much work that has been done on the subject." In the last edition of another London textbook it is stated that [6] "the old view that the causation of arrest of the fertilized ovum was because the epithelium of the tube had been shed by a former catarrhal salpingitis is now held to be untenable because the majority of cases show no such inflammatory changes." I find myself in total disagreement with any such opinions. It seems to me that careful enquiry or examination will show that a high percentage of tubal pregnancies give evidence in one way or another of a concomitant or precedent factor, which for the moment may be called irritation of the pelvic peritoneum.

In thirty-one cases alone (21·2%) have I failed to detect something or other of the kind; sixteen of these were on the right side and fifteen on the left. Even this percentage might possibly have been reduced had I appreciated earlier the significance of chronic appendicular inflammation in relation to tubal gestation.

The factors to which I refer may be summarized as follows: evidence of reduced fertility, of salpingitis, of appendicitis, of pelvic inflammation of any kind, present or past, of previous operation usually abdominal, or of recent delivery.

I propose to review these factors in reference to ætiology. At this point I may conveniently catalogue cases of tubal gestation occurring shortly after operation, delivery or abortion. In all, five cases had an association of this kind as follows:—

(1) Four months after normal first delivery with normal puerperium and no intervening period; appendix removed eight years previously.

(2) Five months after an abortion; one child five years previously.

(3) Forty-six days after an extensive (Fothergill) vaginal plastic operation with curettage. The patient complained that the operation had been a hopeless failure but the removal of an early tubal abortion put her right at once.

(4) Eight weeks after a curettage for subinvolution with excision of cervical polypi.

(5) Thirteen weeks after operation for acute appendicitis; one normal period intervened.

Number 5 alone showed abnormality of the opposite appendage; in this case there were definite old tubo-ovarian adhesions.

I must leave these cases to speak for themselves. The occurrence in two of them of a tubal gestation shortly aftar curettage is most interesting and the relation seems to me likely to be an intimate one although I cannot define its precise nature.

Reduced Fertility.

For statistical purposes I define absolute sterility as two years or more of married life with the tubal pregnancy as a first pregnancy, and relative sterility as five years or more since *one* previous child, i.e., "one child fertility."

Twenty-six cases showed absolute sterility (average 4·7 years) and twenty-four showed one-child fertility with an interval ranging between five and fourteen years. As ten previously sterile women had been married for less than two years and three cases occurred in single women, this gives a percentage of 37·6% of cases showing reduced fertility out of a total of 133 cases. It is difficult to get away from the significance of this as evidence of previous intra-peritoneal trouble. The fact that, in the end, a pregnancy did occur in the previously sterile cases and that a normal pregnancy had already taken place in the relatively sterile, largely excludes developmental causes. The percentage of reduced fertility would have been higher had I included women with a family of two followed by a period of relative sterility, but the factor of voluntary prevention in such cases is likely to be much higher and I thought it better to base my relative sterility figures on one-child fertility alone. I do not pretend to exclude methods of contraception as a cause of tubal gestation, but I have no evidence that they can so act.

A closer study of these cases confirms the impression produced by the high level of reduced fertility. Where adhesions are mentioned I wish it to be understood that these were old adhesions and little likely to have been produced in the course of the immediate illness.

Single women.—Three cases. In two cases (both on right side) there was evidence of round-celled deposit in the outer layers of the appendix and in one of them the left tube was contracted at its fimbriated end. The third case had a normal right tube; the appendix was not seen in this case.

Women married less than two years.—Ten cases. In three cases there was no positive evidence of anything abnormal. In three cases the opposite tube was patent but bound down by old adhesions (with evidence of active inflammation in one); and in four cases was apparently normal, three showing round-celled deposit in the appendix.

Primary sterility (as defined).—Twenty-six cases. Six cases showed no positive evidence of anything abnormal and details were lacking in two. In the remaining eighteen cases there was evidence as follows.

Opposite tube adherent and closed (hydrosalpinx, one case; round-celled deposit in appendix, one case) five.

Opposite tube adherent, narrowed and partly inverted (round-celled deposit in appendix, one case; history of pelvic peritonitis, one case) four.

Opposite tube adherent but otherwise normal (round-celled deposit in appendix, one case) three.

Opposite tube, definite evidence of active salpingitis, two.

Opposite tube normal (round-celled deposit in appendix in both) two.

History of previous abdominal operation (one ovary removed, one case; insufflation and ventrosuspension, one case) two.

Relative sterility (as defined): Twenty-four cases.—In six the opposite side appeared normal without evidence of infection or adhesion. In all of the remaining eighteen there were old adhesions on the opposite side or in the pelvis generally. The opposite tube was closed in four cases (hydrosalpinx in two) and patent in fourteen. These fourteen cases are illuminating. No history of anything likely to have caused adhesions could be elicited in three of them, two gave a history of "peritonitis" after the birth of the last child, one gave a history of severe ophthalmia neonatorum in the last child, one had been under treatment for gonococcal infection immediately before her last pregnancy started, one had had an operation for acute appendicitis four years previously (with one abortion intervening), one had had an interval appendix removed eleven years previously with one abortion two years later, one had undergone a conservative operation for chronic appendage disease eight

years previously and had had no intervening pregnancy, and four were proved by histological examination to have an associated chronic appendicular inflammation.

Direct Evidence of Inflammatory Intra-tubal Trouble.

In studying the likelihood of endosalpingitis as a cause of tubal gestation it has to be borne in mind that mild trouble, with the patency of the tube maintained, is more likely to be a cause than severe infection. I think this is likely to account for the failure to observe the actual evidences of inflammation. I do not know how long it takes for a tube to become partly inverted or "purse-stringed" near the fimbriated end, and it may be that some of the changes so described occurred in the course of the immediate illness. In 130 cases where good particulars are available: 49 showed bilateral old adhesions: hydrosalpinx in 7; opposite tube closed in 10; partly inverted or "purse stringed" in 18; patent but adherent in 11; obvious active inflammation in 3. Of these 26 were on the right side and 23 on the left.

The remainder of the 130 cases, i.e., 81, was made up as follows:—

(1) (*a*) Right tubal gestation, 42 cases: left side normal or, at most, a small cystic ovary; one patient had an admitted history of gonococcal infection.

(*b*) Left tubal gestation, 33 cases: right side normal or at most a cystic ovary; in two cases adhesions which were probably recent and due to hæmatocele. It is, perhaps, worth noting that, in the absence of evidence of intra-tubal trouble, the right side appeared to be affected more frequently.

(2) Six cases of recurrent tubal gestation—the trouble originating on the right side in five cases and on the left side in one. Of these recurrent cases I myself operated on four on each occasion. One showed dense adhesions of the opposite side with the tube apparently closed and an admitted history of gonococcal infection. The case was an emergency and nothing was done to the opposite appendage; recurrence eighteen months later. In a second the opposite appendage appeared normal and the appendix, which was removed, showed no abnormality on section. Recurrence took place one year and eleven months later. A third showed the opposite tube surrounded by old adhesions which were separated; recurrence one year and nine months later. The fourth showed the opposite (left) appendage to be apparently normal; the appendix, which appeared red, was removed at the first operation and showed definite round-celled deposit under the peritoneal coat; recurrence occurred seven and a half years later with two abortions intervening; white leg developed after the second operation. In the fifth case—in which I operated for the first time only—there was considerable inversion of the fimbriated end of the opposite tube; recurrence occurred sixteen months later.

Direct Evidence of Inflammatory Intra-tubal Trouble.

(Total of 130 cases in which adequate particulars are available.)

49 showed bilateral old adhesions

Hydrosalpinx	7
Opposite tube closed	10
Partly inverted or "purse-stringed"	18
Patent but adherent	11
Obvious active inflammation ...	3

75 showed opposite appendage normal (or, at most, a small cystic ovary).

6 were recurrent cases. 4 of these were operated on by myself on each occasion.

Operated on second time alone ...	1
Bilateral adhesions	2
Opposite tube normal; appendix normal	1
Opposite tube normal; appendix abnormal	1
Opposite tube "purse-stringed" ...	1

Evidence of Inflammatory Extra-tubal Trouble.

(*A*) *Evidence in the vermiform appendix.*—My interest in the appendix as a cause of tubal gestation was aroused in my forty-fourth case in which the patient's husband, a doctor, requested me to remove the appendix when I was removing the right tube. This was his wife's first pregnancy; during a holiday in Cumberland he diagnosed what was amiss and took the risk of motoring her straight to see me. Next to his anxiety about his wife lay a fear that I, a personal friend, might imagine he had suffered from gonorrhœa. I duly removed the appendix and found it, so far as external appearances went, absolutely normal; it was not discoloured, swollen, or adherent. Its cavity, however, was filled with pus, and microscopical sections showed considerable disorganization and inflammatory deposit up to the peritoneal coat.

Since then I have made a point of removing the appendix in nearly all cases of tubal gestation. Occasionally I have forgotten to do so and occasionally, too, the appendix could only have been reached by enlarging my incision. Apart from these occasions, I have been able to study the appendix in all succeeding cases and I am strongly inclined to think that it may be a factor in the production of tubal gestation. 102 cases have occurred since routine removal of the appendix was carried out. The appendix had been previously removed in two cases, and was not removed, for one or other of the above reasons, on three occasions This leaves ninety-seven cases, and in thirty there were definite patches of round-celled deposit in the muscularis and subperitoneal coat, sometimes with œdema. Usually the appendix was more or less normal in appearance, but in ten cases it was red or swollen and in six it was adherent. Far be it from me to define the criteria of chronic appendicitis, but the presence of round-celled deposit near the surface of the appendix cannot be a normal condition, and is much more likely to represent primary trouble in the appendix than secondary reaction to recent trouble in the pelvis. Tubal gestation occurred in twenty-three instances on the right side when the appendix showed evidences of inflammation, and seven times on the left; when it was adherent, the right side was affected in five instances and the left side in one. Of these thirty cases the other appendage was apparently normal in twenty-one, but there were old adhesions in nine cases, with the tube closed in three cases and slightly inverted in two. That is to say, at the most only five cases were probable instances of primary appendage disease; or to put it differently, the appendix was probably the primary factor in at least twenty-five. The low percentage of sterility in this group is notable. Only six cases showed either absolute or relative sterility, four being absolute and two relative. This amounts to 20% as compared with 37·6% for the whole series.

I must qualify any conclusion based on these data by admitting that in five cases alone did I detect any history of illness that might have been appendicitis; but on the other hand I have certainly not investigated this possibility as fully as I migt have done.

References to appendicitis in this connection are unexpectedly scarce. Kelly and Hurdon (1905) [7] state that "ectopic gestation is complicated with appendicitis in a considerable number of cases." In 10% of their cases the appendix was adherent to the sac or was acutely inflamed. Hunter Robb [8] in an article on "Inflammatory Conditions of the Appendix accidentally brought to light in Pelvic Operations" found evidence of inflammatory changes in the appendix in 47 of 370 cases. Several reports of solitary cases [9] [10] associate appendix inflammation with tubal gestation. It is obvious that the causes of tubal gestation must be very mild in character and therefore liable to be overlooked. If the appendix is—as I believe it to be—a factor, I do not think it necessarily follows that the effects should be directed on the right tube alone. It is admitted, I think, that appendicitis may be a cause of sterility—in other words, both tubes may be affected. Sterility (or reduced fertility) and tubal

gestation have a certain relationship, as has already been indicated. At the same time, in this present series, evidence of appendicular inflammation was very clearly associated with right-sided trouble.

(*B*) Previous operation in the lower abdomen (excluding recurrent tubal gestation). Twenty-three cases had had a previous operation. Most of these operations were done by others, but the particulars, so far as I have been able to determine them, are as follows: Appendicectomy, eight cases; conservative operation for appendage disease, four cases; oöphorectomy for "cystic" ovaries, two cases; exploratory operations, four cases; ventro-suspension for sterility and dyspareunia, two cases; ventro-suspension and insufflation, one case; abdominal drainage of pelvic abscess, one case; radical cure of left inguinal hernia, one case. In seven of these operation cases there had been no previous pregnancy, in nine there had been no pregnancy since the operation, but in seven cases a normal pregnancy had occurred since the operation. In eight of these there were pelvic adhesions in five cases and hydrosalpinx, closure of opposite tube and "purse-string" narrowing one of each.

Summary in Relation to the Ætiology of Tubal Pregnancy.

(1) Of 133 cases of tubal pregnancy 50 (37·6%) were associated with reduced fertility. Of these fifty cases, plus 13 others not reaching the defined standard of absolute or relative sterility, 42 showed evidence of, or gave history suggesting old peritoneal infection, and three had had a previous operation in the lower abdomen.

(2) Of 146 cases, 50 (including four recurrent cases) showed definite evidence of old pelvic inflammatory lesion and three further cases were possibly of that nature —total 36%.

(3) Of 97 cases where the vermiform appendix was studied, in 30 (31%) there was a history of active inflammatory deposit in the outer layers.

(4) In 23 of 146 cases (16%) there was a history of a previous operation in the lower abdomen.

To some extent, groups 2, 3 and 4 overlap, as there was evidence of inflammatory trouble in both areas in a few cases and it was impossible to define precisely the prime focus.

My data are not sufficient to allow me to correlate these separate percentages but I think I can safely emphasize, firstly, the high proportion of definite old pelvic inflammation of mild degree that was found, and secondly the histological evidence of chronic appendicular infection in an appreciable number of cases.

The table presented herewith summarizes my experience of tubal gestation.

General Ætiology.—146 Cases.

	Side R.	Side L.	Total
No cause found	16	15	31
Direct evidence of intra-tubal trouble	26	23	49
Suggested by recurrent tubal gestation	4	2	6
Suggested by recent vaginal operation with curettage	1	1	2
Suggested by unusual history following abortion or labour	4	—	4
Evidence of extra-tubal trouble:			
In appendix as removed	23	7	30
Suggested by previous operation in lower abdomen	9	14	23
Suggested by adhesions around bilateral dermoids, tubes being normal	1	—	1
			146

I plead, in particular, for more careful statement of operation findings and for further observation of the vermiform appendix in cases of tubal gestation.

REFERENCES.

[1] GEMMELL and LEITH MURRAY, "Two cases of simultaneous intra- and extra-uterine pregnancy; with a review of recorded cases" (see below). [2] SCHUMANN, "Extra-uterine pregnancy" (Appleton), p. 22. [3] LEITH MURRAY, *Journ. Obst. and Gynæc. Brit. Emp.*, vol. xvi, p. 372. [4] STEVENS, "Diseases of Women," 1931, p. 237. [5] "Diseases of Women" (Ten Teachers), 1930, p. 426. [6] STEVENS, loc. cit. p. 243. [7] KELLY and HURDON, "The vermiform appendix," 1905, p. 707. [8] HUNTER ROBB, "Inflammatory conditions of the appendix accidentally brought to light in pelvic operations," *Amer. Journ. Obst.*, vol. lii, p. 229. [9] STATHAM, "Influence of the vermiform appendix on gynæcological surgery," *Brit. Med. Journ.*, 1926, i, 821. [10] WOHLGEMUTH, "The relation of appendicitis to adnexal disease and extra-uterine pregnancy," *Muench. med. Woch.*, 1910, xxviii, 1522.

Dr. A. J. WRIGLEY said that an examination of the figures at St. Thomas's Hospital in the last five years corroborated Professor Leith Murray's observations on the incidence of pelvic inflammation in cases of ectopic gestation. In very nearly one half of the cases he had observed obvious inflammatory lesions were present, usually in the Fallopian tube of the opposite side.

Two Cases of Simultaneous Intra- and Extra-Uterine Pregnancy, with a Review of the Recorded Cases.[1]

By A. A. GEMMELL, M.D., F.R.C.S.(Ed.), and H. LEITH MURRAY, M.D.

THE authors stated that they had collected 213 cases from the literature. Although not of great rarity, such cases were probably outside the experience of most gynæcological surgeons. The two cases were described in detail. In the first case, at operation it was deemed advisable to empty the uterus as well as to excise the ectopic gestation, but in the second case the intra-uterine pregnancy was allowed to go to term. After a careful detailed analysis of many papers on this subject, the authors had come to the conclusion that there was no definite criteria on which to base a prognosis of the fate of the intra-uterine ovum, but when the tubal gestation was removable by operation the prognosis for the intra-uterine fœtus appeared to be good. In twenty-one cases an intra-uterine pregnancy took place in patients who already had an ectopic gestation, and in this group three of the patients died.

Discussion.—Mr. CLIFFORD WHITE said that some years ago he had a case of combined intra- and extra-uterine pregnancy under his care. The patient was admitted to the Samaritan Hospital for Women on October 9, with all the usual signs of intra-peritoneal hæmorrhage. The history stated that the patient was aged 32, and had had one child five years, and one miscarriage six years before. The periods, which were usually quite regular, lasting four days, had ceased on June 27. Vomiting had been severe during July and August, and on one occasion, after a severe attack of vomiting, there was a slight vaginal hæmorrhage, but this was the only hæmorrhage that took place. During September there was some dull pain in the lower abdomen, and two attacks of more severe pain. The pain was described as being like labour pains and not like colic.

On examination, there was dullness in the flanks and an indefinite soft tumour in the lower abdomen, which it was thought might possibly be an ovarian cyst; the patient's collapsed condition made it undesirable to make a detailed examination.

An immediate operation was performed. The left tube was found to be gravid and blood was oozing from the fimbriated extremity. It was removed. Both ovaries were healthy, and neither was removed.

The uterus was enlarged to the size of a twelve weeks' gestation, and had the appearance of a pregnant uterus. Morphia was given freely after the operation, and no signs of miscarriage occurred.

[1] The report of these cases with a full bibliography will be published in the *Journal of Obstetrics and Gynæcology of the British Empire.*

She left the hospital on October 25, and she went into Queen Charlotte's Hospital for her delivery. She was admitted on the 14th of the following April, and was delivered of a female child weighing 8 lb. 13½ oz. On discharge, on April 26, after a normal convalescence, the child weighed 9 lb. 3 oz.

The PRESIDENT, Dr. HEDLEY, Dr. WRIGHT, and Dame LOUISE MCILROY also spoke.

Struma Ovarii (Thyro-Dermoid). A Note on the Teratomatous Origin.

By D. H. MACLEOD, M.S.

STRUMA OVARII—ovarian goitre—is the term given to those tumours of the ovary the greater part of which consists of thyroid tissue. Perhaps thyro-dermoid—a name suggested by Mr. T. G. Stevens—more aptly explains the nature of these growths. In this short communication I have attempted to bring further histological evidence in favour of the teratomatous origin of these tumours.

Up to the year 1931 about 56 cases have been recorded and several hypotheses as to their origin have been put forward. It is generally accepted now that the thyroid tissue is merely a part of a teratomatous cyst, the thyroid entity of which has grown out of all proportion to the other structures, and in certain cases has entirely replaced them.

Much has been written on the subject by Continental and American authors, and Gottschalk is mentioned as having first reported on a case in 1901, but it is interesting to note that Sir John Bland-Sutton in his book on "Tumours," first recognized the presence of thyroid tissue in a large ovarian tumour removed by him in 1893. Gottschalk, reporting on his case, thought that the tissue was derived from the granulosa cells, and called his tumour folliculoma malignum, and it was Pick, in 1902, in a study of the same specimen, who recognized that, not only did the tissue morphologically resemble thyroid, but actually was thyroid. He held the view that these tumours were, in reality, teratomatous cysts in which the thyroid tissue had greatly outgrown the derivatives of other germinal layers. In a few cases recorded, the thyroid element appeared to be the only tissue present. The assumption that dermoids of the ovary may be derived from two or only one germinal layer is probably not true and if serial sections were taken derivatives of all three germinal layers would most probably be found. That one element of a teratoma may entirely replace the other derivatives of the germinal layers is well illustrated in a case recorded by Saxer of an apparently normal ovary in which a single well-developed tooth was found.

Other hypotheses have been propounded as to the origin of these tumours. Kretschmar in 1901 thought that it was a metastasis from a malignant thyroid of the neck, and later, that it was an endothelioma. Voigt considered it to be due to a mucoid degeneration of a carcinomatous tumour, and Bell, in a paper read before the Obstetrical Society of London in 1905, described two cases occurring in association with multilocular pseudo-mucinous cysts and considered that the condition was due to a peculiar colloid degeneration of a cyst-adenoma. Bauer, in 1914, substantiated this view and showed a tumour in which the germinal epithelium had invaded the stroma of the ovary and produced a condition exactly resembling thyroid tissue. He called his case pseudo-struma and went so far as to assert that all tumours containing thyroid-like tissue were of this nature and were really atypical cyst adenomata.

It is known that a dermoid cyst may occur in association with a more rapidly growing pseudo-mucinous cyst in the same ovary and it is not illogical to believe that the thyroid element in such a cyst may outgrow the other derivatives and

mask the teratomatous origin of the tumour. Shaw actually reports on a case of a pseudo-mucinous cyst containing a typical dermoid in which thyroid tissue was found.

The cystic forms of some granulosa tumours show a definite resemblance to thyroid tissue and this undoubtedly influenced Gottschalk in calling his tumour a folliculoma. Frankel and Lederer, in a paper published in 1928, remarked on the similarity and stated that when the proliferating cells in a struma ovarii have not yet assumed the characteristic structure of thyroid tissue they may resemble tumours described as folliculomata. An interesting paper was read at the last meeting of this Section on granulosa cell tumours,[1] and I noticed in one of the slides shown on the screen a distinct resemblance to thyroid tissue.

As regards the incidence of these tumours, Pick found six out of twenty-one teratomatous cysts; King examining 500 cases of ovarian tumours discovered three, whereas Rhodenberg in an interesting analysis of 500 ovarian tumours found nine cases out of sixty-one teratomatous cysts in which thyroid occurred. There is no doubt that if teratomatous cysts were examined systematically the presence of thyroid tissue would be more often recorded.

The tumour may be solid and composed almost entirely of thyroid tissue or more commonly the thyroid may be present as part or whole of a prominence in the wall of a dermoid cyst, or finally thyroid tissue may occur in a multilocular pseudo-mucinous cyst as a part of an included teratoma with or without other teratomatous formations.

The thyroid tissue is usually of the colloid type, but colloid and fœtal types may coexist in the same tumour, as in Outerbridge's case. Areas of malignant changes have been observed in the centre of the colloid mass. Both Moench and Norris showed cases in which areas of adeno-carcinoma could be seen in the centre of the goitre. Proescher and Roddy reported on three cases, one of which contained areas of malignant growth; the patient in this last case died from recurrence. Anspach goes so far as to state that struma colloid may be malignant, though the structure is that of the normal gland. In view of the possibility of this assertion and also that malignant areas in the colloid growth may be missed, a prognosis should be guarded. Areas, showing the histological changes often found in cases of Graves' disease, have been observed in a case recorded by Moench, and it is interesting to note that this case actually suffered from symptoms of hyperthyroidism which completely cleared up on removal of the tumour.

The clinical history and physical signs are not characteristic in these conditions. Menstrual irregularities are frequently noted and the majority of women are multiparæ. The average age is 40. Ascites was stated to be present in 50%. A few cases have developed metastases, as in that reported on by Kretschmar and Norris, but the majority are benign. It would be expected that with such a large excess of thyroid tissue present in the body, symptoms of hyperthyroidism would be almost constantly found. But symptoms of hyperthyroidism are conspicuous by their absence, and on reviewing the literature there are only two cases in which hyperthyroidism can be definitely stated to have been present. One is recorded by Kovac and the other by Moench. In both patients the symptoms disappeared after removal of the tumour. In Moench's case the histological appearance of the tumour was that of a toxic adenoma and showed well-marked epithelial hypertrophy and intracystic papillary tufts. Trapl records a case in which there was a temporary enlargement of the thyroid in the neck after removal of the tumour, and Moench mentions a case in which there was also a goitre in the neck, but that this occurred in a part of Germany where goitre is prevalent and may have been coincidental.

1 *Proceedings*, 1932, xxv (Sect. Obst. and Gynæc.).

Pick assumed that the tissue was thyroid, entirely from its morphological resemblance, but further evidence was brought by Meyer in 1903, who showed the presence of iodine in such tumours. Few cases have been recorded in which attempts have been made to estimate the iodine content. King and Norris in a paper published in 1931 estimated the iodine content in two cases, and gave figures of 11·1 and 12·8 mgm. of iodine per 100 grm. of dried gland.

The two cases I am about to describe were under the care of Mr. Victor Bonney, and occurred within a few months of each other.

Case I.—The patient exhibited no particular symptoms or signs apart from those of a pelvic tumour. There were present bilateral ovarian cysts, both of which on removal appeared to be dermoids. The smaller cyst was about the size of a small apple and contained the usual contents of hair, skin, etc. There was no thyroid tissue present. The larger tumour measured 3½ in. by 2¾ in. and was equally divisible into a cystic and a solid portion. The appearance of the tumour on section is well shown in fig. 1. The cystic portion proved

FIG. 1.

to be a teratomatous cyst and contained an embryonal rudiment which had two poles of attachment. It was covered with skin from which hair was growing. The contents of the cyst were of the usual sebaceous nature. The solid portion of the tumour was attached along nearly one-third of the circumference of the cyst and in close relation to the embryonal rudiment. On macroscopical examination, it was honeycombed in appearance and resembled a colloid goitre, and histologically showed well formed large vesicles containing colloid and lined by a low cubical epithelium (fig. 2).

The cyst wall on approaching the solid portion appears to split so as to enclose the goitre. The tissue separating the thyroid from the cyst consists of loose fibrous connective tissue interspaced with blood-sinuses, and it is worthy of note that there is no ovarian tissue between the cyst and the goitre.

On the other hand, the goitre is encapsuled on its free surface by compressed ovarian tissue continuous with that surrounding the cyst. This appears to suggest strongly that the teratomatous cyst and the adjacent colloid tumour are one entity and the latter not a metastatic growth.

The iodine content of the tumour was estimated and found to be 7·8 mgm. per 100 grm. of dried gland. The method employed was that of von Fellenberg, modified

by Lunde. This is a low figure but within the normal limits and much higher than the iodine content of other tissues.

The low figure is probably due to the large amount of connective tissue diffused throughout the tumour. King and Norris state that the limit of iodine content amongst thyroid tumours ranges from 5 mgm. to 520 mgm. per 100 grm. of dried gland.

Case II.—The case was complicated by an inflammatory condition—the tube being œdematous and adherent to the tumour, which was cystic and about the size of an apple. It appeared to be a dermoid cyst containing an embryonal rudiment covered with skin, and

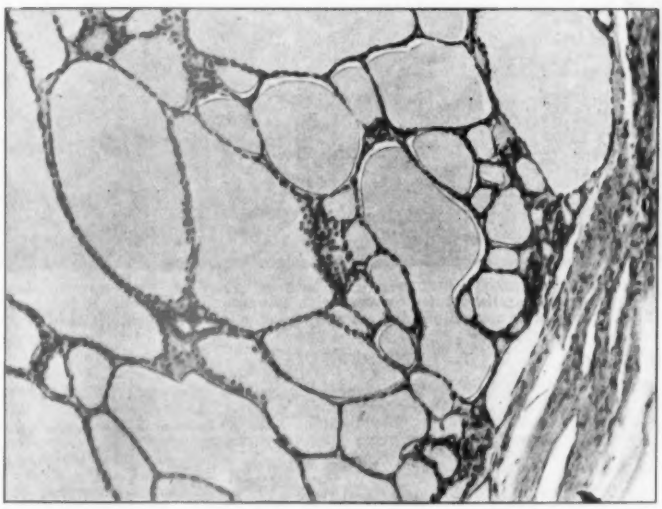


FIG. 2.—Shows typical thyroid vesicles lined by cubical epithelium and containing colloid. (*Case I.*)

with the usual contents of such a cyst. Situated in the wall adjacent to the embryonal rudiment is a solid portion which was homogeneous on section, and showed small hæmorrhagic areas and yellow patches scattered throughout. On histological examination there was found to be present tissue resembling that found in cases of toxic goitre (fig. 3). There was well-marked epithelial hypertrophy with intra-cystic papillary tufts covered with columnar epithelium. There are areas of tissue resembling the fœtal type, and in places vesicles containing colloid can be seen.

The lining of the dermoid cyst can be readily stripped off, and is seen to split to enclose the goitre (fig. 4); the plane of cleavage appears to pass through a vascular lamina. The whole is enclosed, as in the former case, in a capsule formed of condensed ovarian tissue. This supports Mr. Bonney's observation that a dermoid can be enucleated from its bed of ovarian tissue in the same way as can cysts and tumours arising from the follicle. The thyroid portion, contained as it is in a capsule formed of the splitting of the lining of the dermoid cyst, will be enucleated along with the dermoid, and is therefore part of the dermoid. Again, there is no ovarian tissue between the goitre and the cyst, and there can be seen a small islet of thyroid tissue of the fœtal type, separated from the main mass, and in very close association with embryonal rudiment. The cells lining the cyst in both cases somewhat resemble luteal cells. This, together with the fact that they can be enucleated,

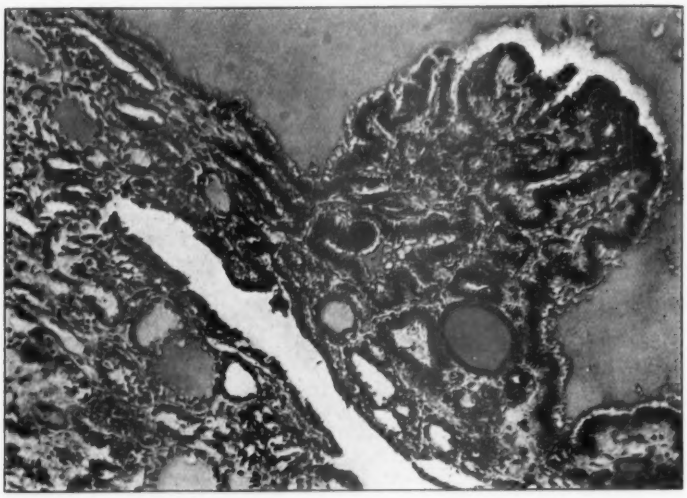


FIG. 3.—Intracystic papillary tufts covered with columnar epithelium. A few vesicles, lined with cubical epithelium and containing colloid, can be seen. (*Case II.*)

FIG. 4.—Shows the stripping off of the lining of the dermoid cyst and its splitting to enclose the goitre. (*Case II.*)

points to a follicular origin of these cysts. It is interesting to observe that, though the histological appearance was of a toxic type of goitre, yet were there no symptoms of hyperthyroidism present in the patient. Mr. Cecil Joll, in his recent book on goitre, states that there is often no correlation between the histological findings and symptomatology in cases of thyrotoxicosis.

Conclusion.—There is little reason to doubt that the tumour actually is thyroid, and not merely resembles it. The view that it is part of a teratomatous formation is supported by the following facts: First, the tumour most commonly occurs in association with an obvious dermoid cyst, and in these cases is always in close relation to the embryonal rudiment. In those cases in which only thyroid tissue is found, it is presumed that the growth of the other derivatives of the germinal layers is in abeyance, a not unknown condition. Secondly, both the cyst and the colloid portion are enclosed in a common capsule of condensed ovarian tissue.

The lining of the cyst readily strips off the capsule, as is the case with dermoids, and further, this lining splits to enclose the goitre. The thyroid, therefore, is situated actually in the lining of the cyst and not outside it, and is, therefore, part of it.

Further, there is no ovarian tissue between the cyst and the thyroid. There is little doubt that the dermoid cyst and the goitre are one entity.

There are no characteristic symptoms associated with these tumours, and cases of thyrotoxicosis are rare, only two cases having been recorded.

[I must express my thanks to the President, by whose kindness I am able to show these cases].

REFERENCES.

[1] ANSPACH, B. M., *University of Pennsylvania Med. Bulletin*, 1903-1904, xvi, 337. [2] BELL, R. H., *Journ. Obstet. and Gynæcol., Brit. Emp.*, 1905, viii, 92. [3] BLAND-SUTTON, J., "Tumours Innocent and Malignant," Seventh Ed., 611. [4] BOLT, W., *Canadian Med. Assoc. Journ.*, 1923, xiii, 250. [5] CLELAND, J. B., *Aust. Med. Mag.*, 1910, xxix, 235. [6] FRANK, "Gynæcol. and Obstet. Pathology" (Appleton and Co., 1922). [7] FRANK, *Amer. Journ. Obstet. and Gynecol.*, 1909, lx, 433. [8] FRANK, J. M., and LEDERER, M., *Amer. Journ. Obstet. and Gynecol.*, 1928, xvi, 367. [9] GEMMELL, J., *Journ. Obstet. and Gynæcol., Brit. Emp.*, 1911, xix, 501. [10] JOLL, C. A., "Diseases of the Thyroid Gland with special reference to Thyrotoxicosis." [11] KING, E. S., and NORRIS, J. H., *Journ. Coll. Surg. Austral.*, 1931, March. [12] MAXWELL, *Proc. Roy. Soc. Med.*, 1910 and 1911. [13] MOENCH, G. L., *Surg., Gynecol. and Obstet.*, 1929, xlix, 150. [14] NORRIS, C. C., *Amer. Journ. Obstet. and Gynecol.*, 1909. [15] OUTERBRIDGE, *ib.*, 1913, lxviii, 1032. [16] PROESCHER and RODDY, *ib.*, 1910, lxi, 619. [17] ROHDENBERG, G. L., *Journ. Lab. and Clin. Med.*, 1927, xii, 211. [18] SHAW, E. H., *Brit. Journ. Surg.*, 1925-26. xiii, 580. [19] SWANTON, *Journ. Obstet. and Gynæcol., Brit. Emp.*, 1907, xi, 244. [20] WOOD, *Proc. New York Path. Soc.*, 1909-1910, lx, 51.

A Specimen of Implantation Endometrioma.

By VICTOR BONNEY, F.R.C.S. (President).

THIS was an implantation endometrioma of an abdominal scar removed six years after myomectomy. Microscopic sections showed areas of typical endometrial tissue containing both glands and stroma lying in a matrix of dense scar tissue. The President said that he had had six such cases, five following hysterotomy and abdominal curettage, and one (from which this specimen was shown) following myomectomy. In all the cases the tumour first became apparent from eighteen months to two years after the operation. At each monthly period the lump became swollen, tender and painful, owing to the endometrial tissue menstruating. The small collections of retained menstrual blood could be seen dotted about the cut surface of the tumour after its removal.

He showed this specimen in order to emphasize the importance of completely covering the wound edges with sheet rubber when performing hysterotomy or myomectomy involving the opening of the uterine cavity. The endometrium differed from all other adult tissues, in that part of it had to be renewed every month, and this no doubt necessitated a degree of vital activity only paralleled by that of the tissues of the embryo. He had often wondered whether tissue culture with fragments of endometrium would not be successful in the same way as it was when embryonic tissues were employed.

Clinical Section.

President—Mr. CECIL P. G. WAKELEY, F.R.C.S.

[*April* 8, 1932.]

Toxic Jaundice (Syphilitic).—TERENCE EAST, M.D.

Mrs. E. M., 54. Jaundice and anæmia, four months. History of proctitis and rectal stricture. Wassermann reaction positive. Liver and spleen enlarged.

Blood-examination.

	R.B.C.	Hb.	C.I.	Van den Bergh
4.1.32	4·5 million	52%	0·58	0·7 units delayed reaction
28.1.32	4·6 ,,	45%	0·49	1·25 ,, ,,
17.2.32	4·5 ,,	66%	0·72	0·8 ,, ,,

Fragility of red cells to saline = normal. No reticulocytosis.

Gastric juice.—Complete achlorhydria.

Urine.—No urobilin. No glossitis.

Treatment.—Iron, mercury, and iodide of potassium.

Comments.—A case in which a syphilitic infection appears to be the cause of the disease: improvement followed the administration of iron and antisyphilitic remedies.

Presumably one may associate the hæmoglobin deficiency and the achlorhydria. The jaundice might be due to hæmolysis associated with the enlarged spleen, or to defect in the liver. The relatively high red-cell count would be against hæmolysis; a defect in the liver appears more likely.

Splenic Anæmia, with Thrombocytopenic Purpura. Cirrhosis of Liver.—TERENCE EAST, M.D.

Mrs. P., aged 31.

Past history.—1929. Appendicectomy by Mr. Harold Edwards.

Shown at a Meeting of the Section in January, 1930 (*Proc. Roy. Soc. Med.*, 1930, xiii, 601). At that time she was suffering from: Purpura with thrombocytopenia and splenomegaly; slight jaundice (van den Bergh increase of indirect reaction pigment); bile salts in urine; pain in upper abdomen, over liver; secondary anæmia. The Wassermann reaction was negative.

The diagnosis of thrombocytopenic purpura with splenomegaly, associated with some defect in the liver, was made.

Splenectomy was performed in February, 1930, by Mr. Harold Edwards.

The spleen was found to be enlarged, and the liver showed hyperplastic nodular multilobular cirrhosis; microscopical examination confirmed the diagnosis.

Blood-count.—Six months after splenectomy, R.B.C. 4·4 million; platelets 175,000; van den Bergh 0·6 units delayed reaction; no bile salts in urine.

Present condition.—No apparent anæmia; no purpura; van den Bergh 0·8 units indirect reaction; trace of prompt reaction.

The case is shown to demonstrate the results of splenectomy. The diagnosis is not to be made in any brief term, for in this patient the syndrome of hepatic insufficiency to a mild degree appears to be combined with an overaction of the spleen, which has been eliminated by splenectomy. Ultimately the damage in the liver will assume important proportions, although the hyperplastic process may keep it back for a long time.

The raised blood bilirubin is an indication that the liver is not healthy, although the patient looks very well.

A Rare Primary Osseous Dystrophy.—PHILIP ELLMAN, M.D.

B. P., a boy, aged 15, was perfectly healthy up to the age of four years, when he had an attack of measles, after which his parents noticed that he was easily fatigued and always wanted to be carried. He complained of increasing stiffness in the limbs generally, swelling of joints and inability to walk. He has had various "stretching," tendon and bone operations with little benefit.

FIG. 1.—Dr. Ellman's case of primary osseous dystrophy.

Family history.—Parents and grandparents healthy. Parents are first cousins. Child had a normal delivery and weighed 8 lb. at birth (breast-fed for three months).

Previous history.—Has had chicken-pox and measles.

Present condition.—The boy now has swelling and limitation of movement of almost all the joints, of the nature of a mixed type of arthritis [i.e. rheumatoid (toxic) and osteoarthritis (degenerative)] arthritis. He has a marked kyphosis and there is a considerable degree of generalized muscular wasting (fig. 1). Spleen not palpable ; no glandular enlargement.

No abnormal physical signs in the heart, lungs, or central nervous system.

X-ray examination of articular system (Dr. Humphris).—All the bones show

FIG. 2.—Skiagram of pelvis showing advanced degree of osteoporosis with considerable degenerative and proliferative changes at hip-joints.

marked evidence of osteoporosis. The shafts of the long bones are attenuated while the epiphyseal ends are enlarged. The heads of the femora are considerably distorted (see fig. 2) and there is marked irregularity of the articular cartilage. There distortion of the lower ends of the femora and upper ends of the tibiæ, and there is well-marked expansion of the ends of the phalanges and metacarpal bones, with slight attenuation of the shafts of the bones. There is destruction of the terminal phalangeal joints. [Several skiagrams shown at the meeting illustrated these deformities.]

Blood-count (Dr. Eidinow).—R.B.C. 3,600,000; Hb. 60%; leucos. 6,250. *Differential*: Polys. 72% ; small lymphos. 18% ; large lymphos. 6% ; basos. 0·5%; hyaline 3% ; eosinos. 0·5%.

Wassermann reaction, negative. Urine, normal.

Blood calcium,[1] 7·88%; Blood phosphorus,[1] 3·44%.

The essential features are the polyarthritis with marked osteoporosis, and hypocalcæmia.

Discussion.—Mr. ROCYN JONES: The striking feature of this case is the decalcification present in all the bones, which is so severe that it is most likely due to some error of metabolism of congenital origin. It is difficult to believe that such a grave and widespread pathological change in the skeleton could occur after one of the maladies common in childhood. The very nature of the disease imposes restrictions upon the remedies available for the cure of the patient's disabilities. Both hips are flexed, making walking difficult, and in one hip there is a severe coxa vara with a slipping epiphysis; in the ordinary way the correction of these deformities could be accomplished by osteotomy of the femora, but in this case such a procedure would be threatened by the risk of non-union of the broken bones. It would, however, be worth while to sling the lower limbs in Thomas' bed-splints and apply continuous weight traction; a good deal of the hip flexion would be corrected in this way. Then the patient would be able to walk with some comfort, and the mere physiological stimulus of walking would abolish the factor of disuse which is aiding the primary cause of bone atrophy. On the analogy of decalcification in fibrocystic disease due to parathyroid deficiency, it might be worth watching the effect of parathyroid in this case.

Dr. PHILIP ELLMAN: On searching the literature I have found only two reports of cases which are so closely allied in all their features to the case shown here that, on the whole, I am inclined to the view that this is one of the rare cases of an "osseous dystrophy" first described by L. Morquio [1] who reports four children in one family all presenting an identical, widespread osseous deformity. The patient in my case is an only child. As in Morquio's cases, the patient's intelligence is perfectly normal, and the parents are first cousins. The skiagrams show profound alteration in osteogenesis, the changes consisting in rarefactions, malformations, destructions and retardations affecting particularly the epiphyses of all the long bones. There is here, as in Morquio's cases, a low blood-calcium.

A further case has been described this year by Meyer and Brennemann [2], with an almost identical deformity and bony pathological changes. This rare condition of an "osseous dystrophy" would appear to be a clinical entity.

References.—[1] MORQUIO, L., "Sur une forme de dystrcphe osseuse familiale," *Arch. de méd. d'enfants*, 1929, xxxii, 129. [2] MEYER, H. F., and BRENNEMANN, J., *Amer. Journ. Dis. Child.*, 1932.

Allergic Headache.—E. STOLKIND, M.D.

Patient, male, aged 19, a clerk, complains of attacks of headache, accompanied by discharge from the nose and eyes. His sister, aged 20, is suffering from pulmonary tuberculosis; his brother, aged 18, is healthy. No family history of allergic disease (hay fever, urticaria, migraine, etc.).

Patient has congenital ichthyosis. His present attacks commenced a few months after his recovery from whooping-cough at the age of three years. His nose and eyes would begin to run at about eleven p.m., and he then "kicked" and cried all night. During the early years he only had these paroxysms once in four or five weeks. Later the frequency of their appearance varied.

The attacks are of various intensity. The more severe attacks commence at night and continue for two or three days. The later paroxysms begin with pain under one eye in the lachrymal sac, which soon spreads to both eyes and the forehead. The pain is severe for about twenty-four hours. There is a continuous discharge from the eyes and much more from the nose, commencing a few minutes before pain starts and continuing through the attack; the mouth is then full of saliva, which dribbles from it. There is no sneezing, itching, or loss of smell.

I saw the patient on March 10, 1932, during an attack. He was awakened before 6 a.m. by severe pain round the eyes and in his forehead. There was nasal blocking

[1] Through the courtesy of Dr. W. G. Wyllie these examinations were made at the Children's Hospital, Great Ormond Street.

with a continuous, thin, watery mucoid discharge from the nose and eyes, and the mouth was full of saliva. He could not bear the light. The conjunctivæ were inflamed and the lids œdematous. Pulse, 54, regular. Blood-pressure, 165/115. Respiration, 24. After an injection of ephedrenalin (Merck) the discharge stopped but started again later very feebly. His head felt easier and he fell asleep. The next day the pain was not severe but the conjunctivæ were still injected and the lids swollen. There was no eruption of the skin and the remainder of the examination gave no further results.

Skin tests (scratch method) to allergens during free period showed irritation to cat hair, dog hair and horse dander but no visible reaction. There was only a positive reaction to asthmatic proteose. The blood film from the finger shows 2·2 per cent. of eosinophil leucocytes and that from the wheal of the arm 2·5 per cent. of these cells. For this examination I have to thank Dr. G. H. Oriel, Dr. R. S. Bruce Pearson, and Dr. F. A. Knott. The examination of the watery nasal discharge did not show the presence of eosinophils, thus favouring the diagnosis of allergic rhinorrhœa.

Rhinoscopy and transillumination of the sinuses (by Mr. Lionel Colledge—between attacks) gave negative results.

Roentgen examination of the sinuses (Dr. Martin Berry): Sinuses—healthy. Numerous depressions in frontal area due to Pacchionian bodies.

Blood-count.—R.B.C. 5,410,000; Hb. (G.O.W.) 96%; C.I. 0·88%; W.B.C. 10,300. *Differential count:* Polys. 68·5%; small lymphos. 18%; large lymphos. 9·5%; large monos. 1%; eosinos. 3%; basos. 0%.

In this case the severe headaches may be the result of the "inflamed" mucous membrane of the frontal and ethmoidal sinuses and lachrymal sac or of the blocking of the ostia of the sinuses.

The relief after injection of ephedrine or adrenalin points to the correctness of the diagnosis of allergy.

It is my practice to test all patients complaining of headache, migraine or other allergic diseases, with allergens (scratching or intracutaneous tests), or by ascertaining the effect of omission of such foods as dairy products, eggs, chocolate, etc., as well as by the omission of other allergens, for periods of from two to four weeks.

Congenital Multiple Lipomata. Loss of Memory.—E. STOLKIND, M.D.

Patient, male, aged 51, railway worker, has had small nodules on the arms since early childhood. These gradually grew larger, increased in numbers and appeared in different parts of the body, especially on the extremities, chest wall and abdomen. No other case of growths in the family. Swellings on the body, noticed about nine years ago, have become larger in the last five years, and during this time he has had pain in the arms. Lately he has been unable to clench his right fist tightly. Good health and happy disposition until January 17, 1932, since when he has had headaches and paroxysms of hot flushes when the face and eyes become very red. These attacks, only lasting for a few minutes as a rule, appear every two or three hours and are followed by fits of shivering. They occur at any time. From this date his mental outlook has completely changed and he is very depressed. He answers questions, but shows no desire to converse with anyone. Often giddy and does not sleep.

On January 22, 1932, he complained of headache and went out for a short ride on his bicycle. He was found by the police thirty-one hours later, having lost his memory. His only thought was of his headache and he had no desire to eat or drink.

Patient is of large build, has bluish red colouring; conjunctivæ injected; pharyngitis. The lipomata are subcutaneous and are symmetrically distributed on

the trunk and limbs, especially on the arms: the head, neck, hands and feet are free. In some places the tumours are in chains and in others in masses. There are only a few small pigment spots on the body.

Eyes: Right pupil larger than left; both react to light and accommodation.

Wassermann reaction, negative.

Slight prognathism of the lower jaw. Sella turcica normal. Brain normal. Eyes (examined by Mr. J. H. BEAUMONT): Fundi and media normal.

Histological report on a nodule from the arm (Dr. W. CARNEGIE DICKSON).—Small oval mass of fat, occasional small vein; no entering nerve trunk. Appears, also on section, to be fat only—a lipoma. Microscopically: fatty tissue indistinguishable from ordinary adipose tissue; presumably a small lipoma.

? Choledocho-Duodenal Fistula.—HAROLD EDWARDS, M.S.

Woman, aged 65. For several years has suffered from a dull pain in the epigastrium with flatulence after meals. Occasionally has had acute attacks of pain under the right costal margin, with sickness. The appetite has always been poor, and the bowels constipated, with occasional diarrhœa. Has never had jaundice. The abdomen is flaccid. The liver is palpable, but does not appear to be enlarged. The gall-bladder cannot be felt, and there is no tenderness over it.

A barium meal shows a diverticulum of the second part of the duodenum, and well marked diverticulitis of the colon. The common bile-duct, the hepatic ducts, and the intrahepatic ducts filled with barium, so that a complete network of the bile passages can be seen in the skiagram. Some of the barium remained in the liver after twenty-four hours, but after forty-eight hours the liver was clear.

Dr. F. PARKES WEBER suggested that the patient might have an old fistulous communication between the gall-bladder and the small intestine, due to a gall-stone having formerly ulcerated from the gall-bladder into the intestine. Extrusion of a calculus from the gall-bladder in this way was known to occur occasionally, because in some such cases the calculus had been subsequently found blocking the intestine.

? Pathological Fracture of Tibia.—HERBERT J. PATERSON, C.B.E., M.C.

Single woman, aged 53 years.

September, 1931.—Noticed left knee slightly swollen and painful.

October, 1931.—Left lower limb gave way while walking. Carried home and was in bed for one month. Diagnosed as a sprain.

November, 1931.—Radiograph showed fracture of tibia. Put on splint.

December, 1931.—Put into plaster.

February 4, 1932.—Admitted to National Temperance Hospital. Considerable swelling of left knee—no evidence of fluid. Much œdema above and below knee. Impaired flexion of knee (40°). Cannot raise leg. Some œdema of right thigh and leg.

April, 1932.—Has had massage for two months. Œdema considerably less and movement of knee improved.

Cœliac Disease.—REGINALD LIGHTWOOD, M.D. (by permission of HUGH THURSFIELD, M.D.).

H. V., female, aged 2 years and 3 months, was healthy until the age of 15 months when she began to waste. She vomited, and diarrhœa alternated with constipation.

On examination.—A pale and wasted child with a peculiar mentality—never speaking and rarely smiling.

Muscles hypotonic; buttocks wasted. Knee-jerks absent. Abdomen: considerably distended, umbilicus everted. No free fluid. Lungs: Percussion note impaired at right base (presumably owing to abdominal distension).

A month ago, when she was admitted, there was a little free fluid in the peritoneum and considerable œdema of the ankles. This œdema disappeared as the abdominal distension diminished.

Investigations.—Stools: Bulky, offensive and "porridgy."

Split fat	... ...	32·38	% *of dried fæces*
Unsplit fat	... ...	26·04	
Total	...	58·42	

or, of the fæcal fat 55·43% is split and 44·57% unsplit

Microscopically: A few fatty acid crystals. (These observations were made before a low fat diet was begun.)

Blood cholesterol = 80 mgm. %. [Normal 100-200 mgm.]

Blood-count: R.B.C. 4,625,000 per c.mm.; Hb. 90%; C.I. 1·0; W.B.C. 10,000 per c.mm. *Differential*: Polys. 50%; lymphos. 48%; monos. 2%.

Mantoux reaction: Negative to 0·1 c.c. of 1 in 1,000 old tuberculin.

Course.—During a month in hospital on a low fat diet the child has been gaining weight (total gain 2 lb. 2 oz.).

Embryonal Adenocarcinoma of Kidney.—REGINALD LIGHTWOOD, M.D. (By permission of H. TYRRELL-GRAY, F.R.C.S.).

Patient, a girl, aged 5 years and 10 months, had, three months ago, a severe attack of hæmaturia lasting fourteen days.

On examination.—A pale, anæmic child with enlargement of the abdomen. On the right side is a large, firm, somewhat nodular mass which extends into the loin and can be palpated bimanually. The liver can be separately palpated.

Embryonal adenocarcinoma of kidney.

Intravenous and instrumental pyelography demonstrates a pressure effect on the upper calyces of the right kidney believed to be due to a neoplasm growing from the upper part of that kidney.

POSTSCRIPT.—An operation was carried out and the right kidney, with a mass attached to it, was removed. On examination the mass was found to be a malignant neoplasm growing at the upper pole of the kidney. The kidney was compressed and its calcyces distorted. The neoplasm was encapsulated, and its cut surface showed areas of hæmorrhage and cystic degeneration.

Histological examination.—Embryonal adenocarcinoma of kidney.

Lymphatic Leukæmia Simulating Aplastic Anæmia.—J. L. LIVINGSTONE, M.D.

P. C., aged 54, a stonemason. Complains of breathlessness, drowsiness, and anæmia, of eight weeks' duration. Since Christmas, 1931, he has had backache and pains in legs, and at the beginning of February, 1932, he noticed the present symptoms and had to give up work; at this time was observed to be pale. He thinks the motions were dark in the middle of February for a few weeks; he has lost at least 8 lb. in weight; appetite good; no vomiting or indigestion. Very moderate drinker; V.D. denied.

He was seen in the out-patient department at King's College Hospital on February 23, 1932, when he was very anæmic; spleen and liver slightly enlarged; a few petechiæ on the chest. Blood-count: R.B.C. 2,390,000; Hb. 50%; C.I. 1·06; W.B.C. 7,200. *Differential*: polys. 20%; lymphos. 80%.

He has been in hospital since March 16 with pulse rate of 84 and pyrexia to 99·2°. Weight 9 st. 3 lb. 12 oz. Anæmic but not wasted; a few old petechiæ on chest; spleen enlarged 1 in. and liver 2 in. below costal margin. Blood-pressure 108/60. Slight cardiac dilatation; urine normal; no retinal hæmorrhages seen.

Investigations.—No occult blood. Achlorhydria. Van den Bergh: Indirect reaction 0·6 unit. Blood-platelets (March 17): 25,000 c.mm. Reticulocytes (March 26): 0·8%. No ova found in fæces. Blood-count (March 18): R.B.C. 1,740,000; Hb. 34%; C.I. 1·26: W.B.C 3,200. *Differential*: polys. 24%; lymphos. 76%.

Treatment.—February 24 to March 16, liver by mouth. March 13 to 30, liver extract (equivalent to ½ lb.). March 31 to date, ventriculin 30 grammes daily with ac. HCl.

Diagnosis.—The absence of occult blood and the blood-counts are against a hæmorrhage from the bowel. There is no evidence of carcinoma ventriculi. *Provisional diagnosis*: Aplastic anæmia.

Dr. NORMAN HILL suggested the use of intravenous "hepatex." He had used this preparation with dramatic results in a case similar to the one shown. It was a case which did not respond to either liver, liver extract or stomach extract by mouth: blood transfusion had been of small benefit. With intravenous hepatex, both red cells and hæmoglobin rapidly rose, and the general condition of the patient improved very quickly.

Dr. TERENCE EAST said that in this case he advocated removal of the spleen after the blood had been brought up to full level by transfusions. He thought that it was a similar case to the one that he had shown, although it had advanced to a later stage. In his case splenectomy had been a great success. He doubted whether there would be any response in the present case to any form of liver extract, as there was not sufficient jaundice to warrant its inclusion in the pernicious anæmia group. He thought that while the spleen was present the bone-marrow probably would not respond.

POSTSCRIPT.—Subsequent history: The patient gradually became worse and died at the beginning of May. The leucocytes gradually rose to 44,000 per c.mm., of which 99% were large lymphocytes. At the autopsy there was no glandular enlargement, but there was a hyperplasia of the bone-marrow, almost entirely of a lymphoblastic type.

Diagnosis.—Obscure type of lymphatic leukæmia (lymphoblastic).

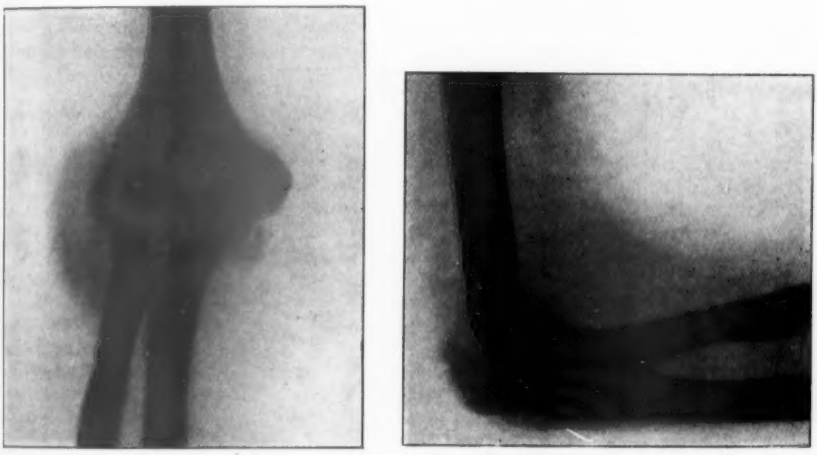
[*May* 13, 1932.]

Lipoma in the Left Submaxillary Region.—CECIL P. G. WAKELEY, F.R.C.S. (President).

Harold P., aged 52, first noticed a swelling in the submaxillary region, three years ago. This caused him very little inconvenience, and for a year or so remained stationary in size. It is about as a large as a chicken's egg, and distinct lobulations can be made out if it is rendered tense. It is quite mobile and painless, and is situated just under the skin and superficial to the submaxillary gland.

Advanced Arthritis, with much Destruction of the Elbow-joint.—CECIL P. G. WAKELEY, F.R.C.S.

Mrs. Florence W., aged 43, first complained of pain in the right elbow-joint four years ago, when the joint became slightly swollen. No history of injury or previous illness. The joint has become more and more fixed since that date, and at present



Skiagrams showing the amount of articular destruction in the elbow-joint.

appears to be almost fixed at a right-angle, with only five degrees of movement. There is some movement of the superior radio-ulnar joint; the hand can be moved from the full pronated position to the semi-supine.

Patient has one child; no history of any miscarriages. All other joints appear normal. No family history of bone disease. X-ray examination shows extensive destruction of the joint with a considerable amount of bony outgrowth from the joint surfaces. Articular cartilage appears to be quite destroyed (see figures).

Rachitic Coxa Vara.—CECIL P. G. WAKELEY, F.R.C.S.

Violet J., aged 5 years, is one of twins, the other child having been stillborn. The mother has had three sets of twins, of which this child is the remaining one of the second set of twins. Of the first set of twins one is alive and has been in a sanatorium; the other one died from an enlarged thymus gland. Both twins in the

third set were stillborn. There is no history of miscarriage, and the mother appears to be quite healthy.

The child was never breast-fed as the mother had not enough milk. She was fed on a variety of patent milks. She did not walk until she was 4 years old and then only with great difficulty.

Skiagram of pelvis and femora showing rachitic coxa vara.

On examination.—The right leg is half an inch shorter than the left. There is limitation of flexion and abduction at the hip-joints, but there is no pain on movement. Both tibiæ are markedly bowed. Skiagram shows a bilateral coxa vara, more marked on the right side (see fig.). There is evidence of rickets, but no suggestion that this disease is active.

Juvenile Tabes Dorsalis with Normal Pupillary Reactions.—C. WORSTER-DROUGHT, M.D.

R. H., male, aged 18. Complains of weakness in both legs, pain in back, and occasional hesitancy in micturition.

History.—Twelve months ago he began to experience pain in the left leg on walking. The pain was shooting in character and extended from thigh to ankle. Six months ago similar pain occurred in the right leg.

On examination.—Pupils equal, central and circular; direct light and consensual reactions normal. Optic discs and ocular muscles normal. Other cranial nerves normal. Vibration sense much diminished over bony surfaces of legs. Arm reflexes normal. Knee- and ankle-jerks absent. Plantars flexor. Abdominal reflexes moderately brisk and equal. Co-ordination normal. Heart normal. Blood-pressure 120/80. Other systems normal.

Blood Wassermann reaction strongly positive. Cerebrospinal fluid: Cells 75 lymphocytes per c.mm. Total protein 0·1%. Globulin reaction positive. Wassermann reaction strongly positive.

Commentary.—This case is shown as a contrast to one which I showed recently before the Section for the Study of Diseases in Children.[1] In that case the only physical signs of tabes dorsalis were Argyll-Robertson pupils and diminished vibration sense, the deep reflexes being normal. In the present case the reverse holds good—normal pupillary reactions and absence of deep reflexes in the lower limbs. Unfortunately it has not been possible to ascertain the serological reactions of the other members of the family as they all live in Wales.

Unilateral Proptosis: Tumour of Optic Nerve.—PHILIPPA MARTIN, F.R.C.S.

Mrs. H., aged 48 years. Seven weeks ago she was told by her son that her eyes were "funny," and she then discovered that she was almost blind in the right eye. She came to University College Hospital three weeks ago asking for new reading glasses. Two years earlier her vision had been R. $\frac{6}{9}$, L. $\frac{6}{6}$.

On April 9, 1932, she was found to have right proptosis straight forwards, with full range of movement and primary optic atrophy.

Light and coarse movements are still perceived. The right pupil is slightly larger than the left and reacts to light and accommodation. During the past few weeks slight divergence has developed.

Wassermann reaction negative. Blood-count normal. Resting pulse-rate and basal metabolic rate, normal. Dr. F. M. R. Walshe kindly examined her and reported that there was no other involvement of the central nervous system.

Two Cases of Slight Polycythæmia with Latent Jaundice.—C. E. NEWMAN, M.D.

I.—Mrs. A., aged 69, complained of indigestion, with vomiting of mucus and pain, half an hour after meals. Constipated. Said to have been operated on for gall-stones seven years ago. Pale complexion. Liver slightly enlarged but normal to touch; spleen not enlarged. Heart: auricular flutter, but little evidence of decompensation. Blood: R.B.C. 5,070,000; Hb. 104%; C.I. 1·03. Van den Bergh: delayed reaction, 1·6 units. Lævulose tolerance: fasting 0·081, ½ hour 0·118, 1 hour 0·114, 2 hours 0·102. Gastric residue: achlorhydria. With histamine: total acid 32 c.c., free hydrochloric acid 22 c.c. Cholecystography: gall-bladder fills and empties normally, no stones. Skiagrams of stomach, duodenum and colon show dilated stomach, emptied in five hours; nothing else abnormal.

II.—Mrs. J., aged 63, complained of insomnia. Had "inflammation of the stomach" four years ago. Lost a stone in weight during last year. Beige complexion. Heart definitely enlarged; poor mitral first sound with localized systolic murmur; soft aortic systolic with loud first sound. Blood-pressure 123/80.

[1] *Proceedings*, 1932, xxv, 1226 (Sect. Dis. in Child., 78).

Liver just palpable, normal to touch. Spleen not enlarged. Urine, temperature and pulse normal. Blood : R.B.C. 5,840,000 ; Hb. 124% ; C.I. 1·06. W.B.C. 6,400. *Differential :* Polys. 86% ; lymphos. 12·8. Van den Bergh : delayed reaction, 2·2 units. Lævulose tolerance : fasting 0·099, ½ hour 0·146, 1 hour 0·125, 1½ hours 0·110, 2 hours 0·101. Gastric residue : achlorhydria—with and without histamine.

The cases both show high red count and colour index, raised van den Bergh, a slight cardiac defect without obvious congestive failure and a defective liver function.

Section of Physical Medicine.

President—Dr. F. G. THOMSON.

[*April* 15, 1932.]

MANIPULATION AS A THERAPEUTIC MEASURE.

By Sir ROBERT JONES, Bart., K.B.E., F.R.C.S.

THIS subject is a very wide one, and has a medical, as well as a surgical, aspect. As a surgeon specializing in orthopædic work, I can only deal usefully with those problems which are associated with my practice. Manipulation, though an important weapon in the hands of the orthopædic surgeon, must be considered by him as only one of many. He is called upon to decide not merely which of the many types of movements he will employ, but whether *any* are needed, and to point out the dangers which may be encountered if manipulation is prescribed for the wrong case. I will limit my remarks to those movements, forced or gentle, which have as their object the restoration of function in joints or muscles affected by injury or disease, or disabilities due to prolonged rest. The subject cannot be adequately dealt with if we fail to consider the preventive side, for it will be conceded by all that in a considerable proportion of cases manipulations are the necessary sequelæ to faulty diagnosis and treatment. My conclusions are drawn from my own experience, and however imperfectly I approach this subject I shall be quite content if I can be of any help in deciding when movements are necessary and when they should be avoided.

For the purposes of the moment I shall use the term manipulation as it is applied to the treatment of adhesions, to the reduction of common displacements, and to the manual rectification of a few congenital and acquired deformities, and further endeavour to assess the proportional value of active volitional as compared with passive movements. I shall do no more than allude to muscular movements induced by faradism or galvanism—useful though they often are—or any of the many forms of electro-therapy.

Adhesions.—We may assume that a joint is stiff owing to the presence of adhesions, either within or without, or both. They may complicate disease or be the sole cause of stiffness.

An adhesion is a band restricting movement between adjacent tissues, due to an effusion, serous or hæmorrhagic, following injury or disease. At its birth it is soft and yielding; at a later stage it becomes fibrous and inelastic, more dense and less vascular, reaching a final stage which may be called cicatricial.

The division into classes, which we term extra- and intra-articular, is useful, although largely artificial.

We find that *extra-articular* adhesions, as the name implies, stiffen a joint by the involvement of surrounding structures. They may be found in the capsule, in the ligaments, in the muscles, or in the tendon sheath. They may interfere with the mobility of a joint from adaptive shortening of muscle or other structure, the result of strain or even posture. They are met with in myositis ossificans and Volkmann's ischæmic palsy, and in many scars about joints.

The *intra-articular* variety may also be due to trauma, frequently associated with infection. It may merely consist of a fixation between folds of the synovial membrane or adjacent capsule, or of any tissue within the joint cavity. Adhesions may also owe their origin to fractures or dislocations of the joints, or to acute and chronic infections.

Adhesions related to injuries, such as strains or fractures, or luxations, require more radical treatment than those associated with definite destructive infections. If adhesions are allowed to form following injuries, either within or without the joint, they call for active, passive, or even forcible, movements. If they are the result of inflammatory lesions, such as arthritis, rest is indicated until active disease and pain are modified, or complete recovery has taken place.

I shall define arthritis as a condition involving bone or cartilage, or both, in contradistinction to a simple synovitis. The mistakes made by the unqualified practitioners are often the result of a false diagnosis. Arthritis is often treated by them as if it merely required the breaking down of adhesions, while our own profession is apt to confuse the two conditions and to allow the simple adhesions to become cicatricial by giving the joint unnecessary and harmful rest. I will, therefore, once more lay down a rule which, with few exceptions, will stand the test whereby we are enabled to make a differential diagnosis.

A differential diagnosis.—A joint whose movement is limited in *all* directions is, or has been, subject to arthritis, while a joint which is limited in certain directions only, movement being normal in others, is not arthritic. This is more obvious in joints movable in many directions—such as the wrist, hip, shoulder, and spine—than in the knee or elbow where movement is mainly one of flexion and extension. This does not apply to septic infections involving the articular or periarticular tissues, or to fractures within the joints, or to joints temporarily stiffened from long fixation.

It is well to remember that a joint whose movement is not limited in every direction is free from arthritis. Again, if we cannot find any limitation of movement in a joint it is free from both arthritis and adhesions. We must, however, know precisely the movements of which normal joints are capable. This is especially the case in the knee and shoulder and the complex articulations of the foot.

The spinal column is a good concrete example to illustrate the differential diagnosis. A patient may complain of pain in the back, with or without pressure, and he is asked to flex, extend, rotate, and laterally move his spine. If he does this freely in each direction we may safely affirm that there is freedom from both arthritis and adhesions. If he cannot flex it fully or deviate it laterally, or rotate it, but can hyperextend it normally, we may assume the absence of arthritic changes. We are usually safe, therefore, in deciding that a spine with movements limited in all directions is arthritic; and further, if one or more of its movements is normal in range we can exclude the presence of arthritis.

There are many other helpful differential signs which I cannot discuss in the time allowed to me. I may mention, however, that stiffness rapidly following trauma—excluding fractures and displacements—is suggestive of adhesions. The same is true of superficial tenderness over a limited area, either on movement or pressure, or both. In arthritis the joint is generally warmer over the whole articulation, and although adhesions may produce a localized rise of temperature we usually find no difference from the normal. We note that muscular wasting in an inflamed joint is in excess of that caused by mere desuetude; this is not the case in adhesions.

Radiography here, as in all branches of medicine, is an essential aid to diagnosis. No matter how experienced we may be, we cannot afford to dispense with it, even in the apparently simple and obvious case. Not only should we insist upon procuring a film, but it is equally important that we should welcome the radiologist's

reading of it. Some surgeons resent this and say, "Give me the film so that I can read it for myself": but this is an arrogant and stupid attitude, and not to the patient's advantage. In Liverpool I constantly, and with profit, confer with my friend Thurstan Holland. Radiography is not merely called for as an immediate measure, but is of immense value in a case of long standing, especially in the adult. There are many cases in which a patient has complained for months of a stiff and painful joint. If a skiagram betrays no changes in the joint surfaces we are generally safe in assuming the absence of tuberculous, septic, or rheumatic invasion, and this knowledge is of inestimable clinical importance. Although this does not exclude synovial tuberculosis in the young, or a villous affection of the synovial tissues in the late adolescent or an enlarged post-patellar pad, or a displaced semilunar cartilage, there are other signs to which we can appeal in order to differentiate these conditions. A slightly bent knee, which may have existed for many weeks or months, negative to radiology, is suggestive of a displaced semilunar cartilage. An inflamed post-patellar pad can be felt enlarged when compared with that of the opposite side. A villous synovial membrane can be diagnosed by palpation and confirmed by thickened synovial fluid on aspiration, while a bony block to full extension, confirmed by a skiagram, is characteristic of a displaced spine of the tibia. A knee which can voluntarily be fully extended, painful and of long standing, negative to an X-ray examination, is almost always affected by adhesions.

These are all simple tests, which should prove helpful to practitioners when the problem of rest as opposed to movement is under consideration.

A knee, stiff and flexed, with limited movement, should be the subject of careful consideration before we decide upon any form of manipulation.

The prevention of adhesions.—In the treatment of joints, injured or diseased, our object is to obtain the best functional results. These are attained by rest, by movement, or by a combination of both. A movable joint is not necessarily the best functional result. I have already stated that an arthritic joint requires a rest until all inflammation has subsided. This is particularly true of a tuberculous joint, which not only resents movements, but yields the best functional results when recovery ends in a bony or short fibrous ankylosis. It is true that in certain cases, after many years of firm, fibrous ankylosis, a varying degree of voluntary movement takes place. This is especially the case in the hip, and is usually associated with a disappearance of the femoral head and neck when the joint surfaces have been relieved from contact. Nature brings about this result with less immediate risk than art, but I am often confronted with tuberculous joints where this movement has been their undoing, even after many years of presumed recovery. It is for this reason that I have advocated an *early* operative bony ankylosis in the adult. If disease is *advanced*, the results, especially in the hips, are not so effective. The operation aims at the removal of all diseased structure so that recovery is complete. This is not to be confused with the so-called bony extra-articular fixation, which makes no pretence at excising the tuberculous débris, and of which the most that can be expected is that it should act as a splint to secure rest until recovery takes place, with immobility later.

In certain cases of chronic arthritis of a septic or rheumatic type it is often possible to prevent the formation of firm adhesions when the active painful stage is passed. The patient may be allowed to move his joint within a painless area, or even the surgeon may possibly help. If the patient can move his joint voluntarily and without pain he may be allowed to do so several times a day. If passive movement is employed, once a day is sufficient, and is not likely to cause a reaction.

There are certain rules which we should observe before movements are undertaken either by the surgeon or the patient. A precise diagnosis should be made in

order to appreciate the pathological conditions. Torn ligaments or muscle insertions should be protected from strain ; a joint may be moved in many directions provided the injured tissues are not stretched. Although passive movements must be carefully supervised, massage of a gentle type can safely be practised immediately following injury, even before effusion has taken place ; it checks the effusion of lymph, relieves pain, and allows tissues to proceed to rapid recovery. The masseur should be warned, when necessary, against associating massage with movement, otherwise movement of the joint may disturb tissues which should be left at rest to undergo repairs. When a ligament is injured its anatomy and function should be visualized so that the movements allowed do not disturb the joint. It is a mistake to treat the joint as if an inflammation existed, because carefully conducted movements expedite function. When a ligament is torn I apply a pressure pad with a bandage to it and massage the area from time to time. Local effusion is lessened or even prevented by pressure, for pain is due to tension caused by effusion, and adhesions result from tension. If the joint itself is sprained, elastic pressure should be applied to minimize effusion, which strains injured tissues. In the stage of effusion I forbid any movement which causes pain. If this rule is neglected the ligaments may yield and lengthen under strain, and so allow of an erratic deflection of body-weight in the lower limb, especially noticeable in the ankle. When walking is allowed, precautions must be taken to secure a correct alignment.

Stiffness due to the fixation of joints.—I have frequently emphasized the fact that a short period of fixation of a healthy joint in a normal position never results in more than a passing stiffness in the child or young adult. This does not apply to the old. I lay stress on certain principles based upon a very extensive experience. The first is that a joint kept at rest should never be hyperextended. This is a form of trauma productive of firm adhesions in which the capsule of the joint participates both on its anterior and posterior aspect. It is advisable, therefore, if a joint has to be fixed, to keep it in a slightly flexed position. This will be particularly obvious to those of you who practised during the European war. You will never forget the very intractable rigidity of the metacarpophalangeal joints which resulted from the prolonged use of a misapplied dorsiflexion wrist splint. Hyperextension of phalanges resulted in a stiffness which months of massage and passive movements failed to affect, and brought massage into disrepute with the authorities. The most effective treatment consisted in keeping the metacarpophalangeal and the phalangeal joints flexed for three or four weeks before subjecting them to active or passive movements. The knee frequently presented a similar problem, due to sagging of the lower end of a fractured femur, and required a similar solution. I would, therefore, respectfully but emphatically impress upon you the dangers of hyperextension. Another point is to recognize the value of training muscles to contract even when they are not allowed to move a joint. This is best illustrated by the quadriceps. When the knee is kept at rest the muscle should be trained to pull upon the patella frequently each day. Other muscles can be educated similarly. These movements prevent adhesions forming within the muscles, and between them and their sheath, while later, when the joint is allowed to move, the muscles do their work more effectively. When the patient cannot be educated to perform these movements graduated faradism may be applied. Furthermore, we must make it a rule that movements should be practised in all joints which have muscular attachments associated with the articulation which is temporarily fixed. This is illustrated by the shoulder, wrist and fingers which are all in muscular association with the elbow.

A very intractable form of stiffness occurs in compound suppurative fractures about joints. This is due to a mild septic infiltration of the periarticular tissues, and does not respond favourably to forcible manipulations as applied to simple adhesions. Before any movement is attempted the fracture should be so splinted as

to prevent strain. The manipulation should be performed in stages, with intervals of a few days. During these intervals the joint should be rested on a splint, If the movement thus secured is retained, another stage may be attempted. If the joint becomes ankylosed in the position to which it has been moved no further attempt should be made to increase the range. If the resistance is so great that manipulation is ineffective, a slow, gradual stretching of the joint may prove successful. With this end in view the joint should be bandaged to a splint, with or without traction. Needless to say that in this type of case the joint should have been mobilized before the cicatrization of tissues occurred.

The mobilization of arthritic joints.—Before proceeding, we must know when a joint has recovered from disease. Apart from the important information supplied by successive skiagrams we must be familiar with the signs of cessation of destructive processes.

We may assume that a joint has recovered from disease when its range of movement is not diminished by use, or, in the case of a firm fibrous ankylosis, when its position does not alter by use. If an increase in movement follows the cessation of treatment, no matter how slowly, we should trust to active rather than to passive movements and these should be practised in the absence of weight-bearing. If this range of motion ceases and then remains stationary for a time, very cautiously conducted passive movements should be tried. This is in the nature of an experiment under close observation. We may practise gentle movements also in non-suppurative septic joints when acute symptoms have ended, and again carefully note the results. We must beware of inflammatory reaction. Whenever practicable I prefer active to passive movements; being voluntary, they are sure to be gentle and limited by pain while the muscle itself is truly exercised. The brain cells are employed here which is not the case in the passive type, nor are they employed when the faradic current is used. Unfortunately, active movements are at times neither possible nor effective. Passive movements, unless expertly administered, are apt to be overdone and to interfere with repair. They are often necessary in young children and in nervous people, but when possible they should be employed as an aid to the active type. The masseur, unless instructed, does not know that it is rarely necessary to put a joint through its movements passively more than once at a treatment, and that, for purposes of re-education, he should encourage exercises of the active type. I constantly meet with the evil effects of what I have termed the "pump-handle" method which causes the joint to become sore, swollen and stiff instead of becoming mobile. Passive movements should be carefully regulated and are intended to pave the way for voluntary motion; active movements require hardly any supervision.

Forcible manipulations.—This is a branch of manipulative surgery which has been so neglected as to bring considerable disrepute upon our profession. This neglect has proved a rich harvest to the bone-setter. I referred to it at some length in a recent lecture, so I will not now elaborate the subject. It is sufficient to say that we should mend our ways rather than abuse the unqualified. Dramatic successes at their hands should cause us to inquire as to the reasons; it is not wise or dignified to waste time in denouncing their many mistakes, for we cannot hide the fact that their successes are due to our failures, and that it is only by adding to our knowledge and perfecting our technique that we can hope to banish the bone-setter from our midst.

We have already discussed the type of joint which requires forcible movement. We have no time to enter into detail concerning the art of manipulation. There are, however, certain points to which attention should be drawn. Recent adhesions may be broken down under gas-and-oxygen, but when we deal with a firmer variety a more complete anæsthetic is required; otherwise, they cannot be dealt with effectively. Complete relaxation is essential; there must be no muscular resistance

We must not only know the normal range of movement, but, as this differs in various individuals, we must always take the healthy joint as a guide, comparing its movements during the operations with those of the affected side. If we neglect this, it is very easy to strain such a joint as the shoulder. Unless adhesions are unusually firm I prefer breaking them down completely rather than in stages. When the patient recovers from unconsciousness he should awaken with the position of his joint in full correction. This has an excellent moral effect.

I will describe the manipulations I employ when the knee is affected. Other joints are similarly treated, having regard to their anatomical differences.

With the patient lying on his back, the joint should first be fully flexed, and in that position the leg is rotated inwards and outwards. The rotation should be continued while the knee is slowly extended, care being taken that the extension is complete and remains so without pressure. The knee is again flexed over the surgeon's arm which is placed across the popliteal space. In this way the tibia is levered slightly forwards. If the adhesions are in front of the joint the knee should be flexed while the hip-joint is hyperextended, in order that extra tension may be put upon the structures in front and above the joint. This last movement is a very important one, and is generally neglected. After the special movements required to reduce a semilunar cartilage, both in the recent and in the old case, the rotary movement I have described should be practised. A semilunar cartilage may remain displaced for many months, the knee being in slight flexion, and is usually easily reduced. If, after the manipulation, the knee does not remain lax in full extension, one may be sure that the operation has failed.

Great care is needed in breaking down adhesions of the shoulder in elderly people. The head of the humerus should always be protected by placing the fist in the axilla. Fracture or dislocation is usually associated with external rotation. The scapula should be fixed until the arm is abducted to a right angle.

After-treatment following forcible manipulation.—Active movements should be begun as soon as the patient is awake. These may be assisted passively once a day. Effusion sometimes occurs in a joint, suggestive of the rupture of intra-articular bands. Unless the effusion is associated with a decreasing range of movement, it can be ignored and treatment can be continued with safety. If movement becomes more limited the joint will require rest. If, even in the presence of pain, the range of motion is increased by exercise, *rest is contra-indicated.* I would ask you to note that pain which is sharp and of *short duration* is negligible, but if pain *persists* when the joint is at rest it should be considered a danger signal. If the patient is able to exercise his limb freely, let him do so; it is more efficacious than any form of physio-therapy.

Movements, either gentle or forcible, must always give place to primary reduction of displacements or fractures. Whenever we speak of mobilization in fractures or dislocations we must presuppose their reduction. In the various fractures of the elbow-joint acute flexion *in the presence of displacement* is a dangerous proceeding. It may give rise to the spectre of ischæmic palsy and favours the production of bony developments known as myositis ossificans. It cannot be repeated too often that in this latter condition rest is imperative until the deposit of bone is ended, or absorption takes place. Even massage is contra-indicated. In ischæmic palsy, which is due to venous obstruction, we must relieve the immediate effusion of blood and, as soon as it is safe, reduce, by operation if necessary, all bone which obstructs movement. If reduction of displacement and freedom of muscle action are allowed there will be no need to fear loss of function, and neither massage nor passive movements are essential, although they may be helpful. Both massage and passive movements are necessary in old malunited fractures or displacements.

A correct alignment is of more value in fractures of long bones than an end-to-end apposition where there is even a slight angular deflection, and in the case of the

lower extremity we must realize that firm osseous union takes longer to occur than textbooks state. A fracture which resists movement, when tested by the hands, will often shorten when subjected to body-weight. This must be remembered, more particularly where the femur is concerned, if walking is allowed without adequate protection. I have often straightened a crooked thigh by a cross breaking strain, effected by manipulation, after eight weeks, without actually fracturing it. Firm union is usually rapid after this manœuvre, whereas, if an open operation is performed, a much longer period of rest is required, more especially if a plate is used. In the ambulatory treatment of fractures about the ankle a correct alignment, as elsewhere, is of paramount importance, and the greatest care should be taken to reduce the backward displacement of the foot. The astragalus must be in normal relationship to the articular surface of the tibia.

In congenital deformities the best examples of alternating manipulation and fixation may be illustrated by club-foot and congenital dislocation of the hip.

The short time at my disposal has prevented me from dealing with more than a few aspects of manipulation as a therapeutic measure, and with these other than briefly. There is so much that could be said on the manipulative reduction of displacements and deformities, on the manipulative indications in rheumatoid conditions, and on the assisted active movements in acute septic arthritis. This is, however, impossible, and I will conclude with a brief summary of the points which I desire to emphasize.

The prevention and limitations of adhesions.—Inflammatory symptoms are lessened by preventing strain on the injured parts, by obstructing local effusion by pressure, and by early massage of the injured structures.

If passive movements are practised they should be conducted without straining the injured structures.

Early active function should be encouraged. Torn structures should be shielded from an erratic deflection of body-weight.

Muscles should be voluntarily exercised, even when covered by splints, and adjacent joints should be kept mobile.

The differentiation between arthritis of the joint and adhesions about it.—With rare exceptions, a joint is not arthritic when movement is free, even in one direction. Restricted movements due to adhesions follow very rapidly upon injury.

Traumatic arthritis follows an injury in about a fortnight. A joint which is the seat of arthritis should not be moved until all inflammatory symptoms have subsided, and then under strict supervision and limitation.

If simple adhesions are to be broken down, and unless they are unusually firm, the joint should be put through its complete range of movement on one occasion.

Firm fibrous ankylosis following septic arthritis or compound fractures about joints.—The joint should be moved in stages of a few degrees followed by a few days' rest on a splint. If the range of movement is maintained, further movement and splintage is indicated. If the joint remains fixed in its new position, further movement is temporarily contra-indicated.

When movements of a joint are prescribed after fracture of a long bone, the fracture should be protected by splints.

Recent fractures through joints should not be mobilized without first reducing displacements. Ambulatory treatment should not be permitted unless reduction is complete, and only then if correct alignment is assured when the patient walks.

Discussion.—Mr. T. P. McMURRAY asked whether Sir Robert Jones thought that after a definite displacement of a semilunar cartilage a manipulation was ever successful in producing a permanent cure; by a permanent cure, he did not mean a reduction enabling the patient to walk about comfortably, but a cure which enabled him to carry out active athletic exercise, such as football.

Dr. EDGAR CYRIAX said that he had often met cases of "locked" vertebræ, and considered that such locking was due to reflex muscular spasm induced by impulses from the vertebral joints affected by the displacement. The application of vibrations or gentle pétrissage and carefully stretching the part, prepared the way for subsequent manipulation which, if successful, permanently removed the locking. He regarded locking of the vertebræ as pathognomonic of displacement.

Sir ROBERT JONES, in reply to Mr. McMurray, said that it was extremely difficult to determine whether a semilunar cartilage was absolutely displaced or not.

In reply to Dr. Cyriax: He had never yet seen a case in which there had been a definite locking of the vertebræ, and in which the skiagrams or any method of physical examination had shown a real displacement. If one could see these displacements by these means then it would be more easy to understand the mechanical causes which had led to the locking.

Section of Urology.

President—Mr. RALPH THOMPSON, Ch.M.

[*February* 25, 1932.]

Transplantation of the Ureters into the Large Intestine.[1]

By CYRIL A. R. NITCH, M.S., F.R.C.S.

EXPERIMENTAL.

THE story of the experimental work on dogs is as disappointing as it is long. The mortality was very high, being 60% for unilateral and 87% for bilateral transplants (Steinke) [1], and most of the survivors developed some form of renal infection.

Peterson [2], in a review of the various methods of experimental transplantation, stated that he had not been able to trace a single case in which the kidneys were found to be normal beyond dispute, for the post-mortems on all animals surviving for any length of time showed unmistakable evidence of either stenosis of the ureteral orifice, hydro-ureter, hydronephrosis or pyelonephritis.

The chief causes of the high operative mortality in dogs are the technical difficulties of the operation, the small ureter and the rigid thick-walled rectum peculiar to this animal, while the renal infections in the successful cases can be ascribed to the mode

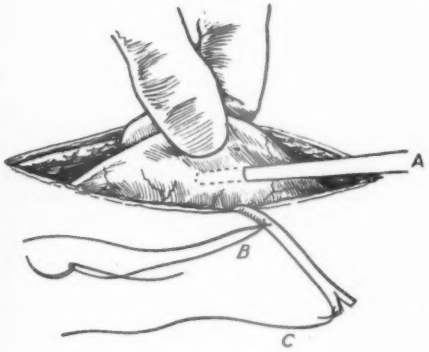


FIG. 1.

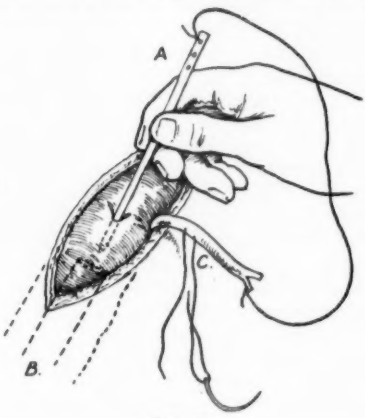


FIG. 2.

FIGS. 1 and 2: WALKER-TAYLOR'S ASEPTIC-IRREVERSIBLE-TUNNEL TECHNIQUE.
(After Walker-Taylor, *Aust. and N.Z. Journ. of Surg.*, 1931, i, 158.)

FIG. 1.—*A*, Blunt dissector burrowing tunnel beneath muscular coat. *B*, stay suture for attaching ureter to entrance to tunnel. *C*, suture in split end of the ureter.

FIG. 2.—*A*, the piercing instrument about to perforate mucosa and enter *B*, the rectal tube, through which it is withdrawn pulling the ureter after it into the tunnel. *C*, stay suture.

of implantation, for in the majority the ureters were transplanted by the "direct" as opposed to the "oblique" method.

In 1909 Coffey [3] made a notable advance with his oblique submucous method, and stimulated fresh interest when he showed several specimens from dogs killed three to five months after operation with no signs of renal infection. However, further experimental work on similar lines by Coffey and others has been disappointing both as regards mortality and renal infection.

Walker-Taylor [4] in 1930 conceived the idea of tunnelling instead of dividing the wall of the bowel and by means of his latest aseptic-irreversible-tunnel technique has succeeded in eliminating peritonitis and reducing post-operative renal infection (figs. 1 and 2).

[1] The operation was illustrated by a cinematograph film.

Animals operated on by Coffey's [5] latest technique, oblique transplantation with delayed fistula formation by transfixion suture (figs. 3 and 4), in his words "show incomparably better results than have been exhibited by any other method." More than a dozen specimens obtained by him up to six months after operation all showed normal kidneys. If this operation yields as good results in a larger series of animals and after a long period, and if it is not followed by stenosis of the ureteric orifice, it will undoubtedly be the operation of choice in suitable cases in man.

Historical.

The earliest attempts to divert the flow of urine from its natural receptacle were made in the endeavour to relieve the distressing symptoms associated with extroversion of the bladder. The first recorded operation for this purpose was performed in 1851 by Sir John Simon [6] of St. Thomas's Hospital. He established a fistula between the ureter and the rectum by means of a tight ligature passed through their adjacent walls with an ingenious instrument he devised for the purpose. Subsequently he ligatured the lower end of each ureter. The operation was not entirely successful, for though some urine passed by the bowel the ureteric orifices were not completely obliterated. The patient, a boy aged 13, died a year later and at the post-mortem "the ureters were blocked with calculi and both kidneys were seriously diseased." It is interesting to note that Coffey's latest technique (and the one which has been more successful in dogs than any other) is similar in principle to the operation devised by Simon over eighty years ago.

The next attempt was made twenty-seven years later by Sir Thomas Smith [7] of St. Bartholomew's Hospital in 1878. He actually transplanted each ureter into the back of the ascending and descending colon, so to him belongs the credit for the first operation of this nature. Although it failed, it deserves our recognition as the work of a pioneer and a brilliant surgeon. He operated on the left side first, but the ureter came away from the bowel and, unbeknown to him, its lumen was obliterated by scar tissue and the kidney atrophied. The patient recovered and, being in good health, fourteen months later the transplant was done on the right side, but unfortunately the ureter was so compressed by the sutures that death from suppression of urine took place on the third day.

After an interval of thirteen years in which not a single case was recorded, though some may have been attempted, surgeons suddenly awoke to the possibilities of the operation, for between 1891 and 1897 a number of cases were reported in which the operation was performed for growths, tubercle and fistula of the bladder as well as for extroversion. The dangers of leakage, stenosis and renal infection were fully realized and many methods of overcoming them were devised. Trendelenburg [8] (1895) preserved a button of vesical mucosa; Boari [9] used a metal button; Tuffier [10] (1896) used ureteric catheters, and Rein [11] (1894) and Chalot [12] (1896) tied tubes of glass and of nickel into the ends of the ureters, but those cases which did not die of shock or peritonitis succumbed sooner or later to pyelonephritis.

In this period the transplantation was effected by the direct method with little or no attempt at valve formation until 1896, when Krynski [13] and later Martin [14] (1899) placed the ureters between the walls of the bowel in imitation of their vesical course, while Fowler [15] (1898) made a valve with a flap of rectal mucous membrane.

Though many surgeons reported cases operated on by one or other of these methods, the immediate mortality was still very high and most of the survivors died of renal infection within two and a half years.

The only operation with almost negligible mortality and prolonged survival was the extraperitoneal rectal transplantation of the ureters with a rosette of bladder, performed by Lendon [16] in May, 1899, and by Peters [17] in July of the same year. Their two patients were alive and well seven and four years later and several cases operated on by other surgeons were successful. But of course this operation could not be employed for pathological lesions of the bladder.

In 1907 Sir Harold Stiles [18] introduced his semi-oblique method which was attended with remarkable success, for five of his cases (traced by Grey Turner) were alive and well six, nine, fifteen, sixteen and twenty years after operation.

Subsequently Grey Turner [19] (in 1929) reported seventeen cases operated on by the same method between 1912 and 1927 with four deaths, the survivors being quite well from one and a half to fifteen years after operation. These figures, given by two surgeons whose reports can be relied on, make me wonder if the more complicated oblique transplantation is necessary, but on the whole I think that it is worth persevering with, for the ureter is less liable to be compressed and the valvular action diminishes the danger of ascending infection. Moreover, we must remember that most of Stiles' and Grey Turner's operations were performed in two stages and all were for either extroversion or epispadias, so that in most of their cases the ureters and kidneys would be more or less healthy.

Finally in 1925 Coffey [20] performed his first oblique bilateral transplantation with tubes in man, and since then has so improved his technique that in his latest

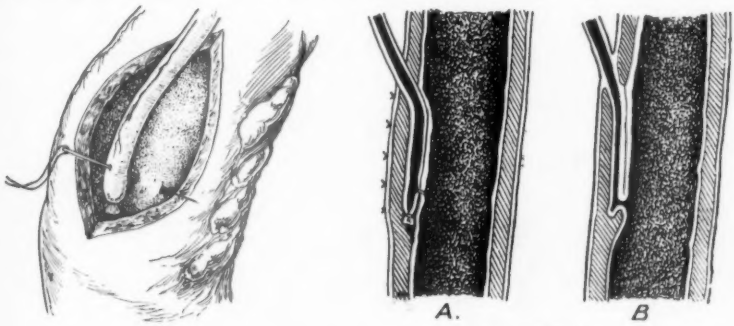


FIG. 3. FIG. 4.

FIGS. 3 and 4: COFFEY'S TRANSFIXION SUTURE TECHNIQUE.

(After Coffey, *Brit. Journ. Urol.*, 1931, iii, 419.)

FIG. 3.—Needle transfixes ureter and intestinal mucosa and carries a doubled ligature of fine thread which is tied firmly and eventually cuts through both coats, leaving a uretero-intestinal fistula.

FIG. 4.—Longitudinal section. *A*, ligature tied and ureter embedded. *B*, fistula formed after ligature has cut out.

publication [5] he is able to record thirty-five cases, both simple and malignant, with a mortality from all causes of 20% and a mortality directly attributable to the operation of only 14%.

TWO STANDARDIZED OPERATIONS.

From the experience gained both clinically and experimentally two operations have now been standardized, each giving satisfactory results. They are the semi-oblique method of Stiles, with the catgut urine guide of Charles Mayo, and the oblique interlamellar method of Coffey, with tubes or catheters. Coffey's method imitates as closely as possible both the vesical course of the ureter and the valvular action which prevents the irregular high pressure in the muscular bowel being transmitted to the kidney, in which the pressure is low and regular. But in spite of this we cannot overlook the fact that the results of the Stiles operation, in which there is no attempt to make a perfect valve, are remarkably good.

The third method of oblique transplantation with delayed fistula formation (figs. 3 and 4) devised by Coffey is now on trial and promises to give even better results.

Stiles' Operation (figs. 5 and 6).

The ureter is divided as low as possible, great care being taken to preserve its blood supply. Its end is then cut obliquely and a catgut suture is passed through its point and tied; the short end is threaded up the ureter (Mayo's urine guide) and the other is armed with a needle. A small transverse incision is now made in one of the longitudinal bands in the lower end of the pelvic colon and the mucosa punctured. The needle carrying the suture on the ureter is passed into the lumen of the bowel through this opening and brought out half an inch lower down. The ureter is then drawn into the bowel and kept in position by tying the suture. It is finally buried in the wall of the intestine for a distance of one and a half inches by two rows of Lembert's sutures in the manner of a Witzel gastrostomy. The opposite ureter is transplanted at a higher level two or three weeks later.

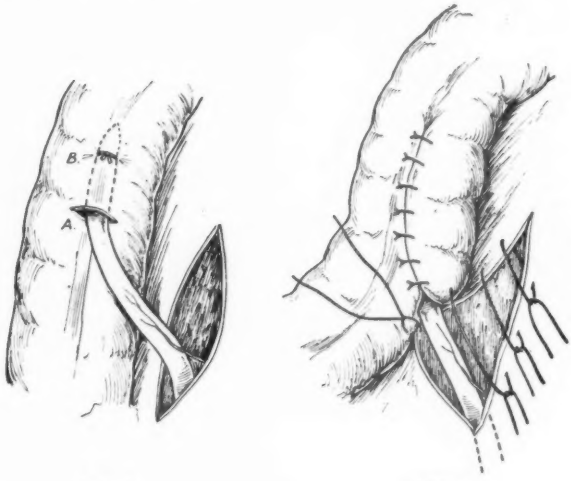


Fig. 5. Fig. 6.

Figs. 5 and 6: Stiles' Operation. (After Grey Turner, *Brit. Journ. Surg.*, 1929).

The ureter passes through all the coats of the intestine at *A* and is held in position by a stay suture at *B*. It is then buried (fig. 6) by a series of Lembert sutures.

Coffey's Operation with Tubes or Catheters.

A sigmoidoscope is inserted, the pelvic colon is clamped, and the bowel thoroughly irrigated, first with water and finally with mercurochrome by means of a transfusion needle which is passed through its wall just below the clamp. The rectum is then stuffed with strip gauze and the sigmoidoscope withdrawn.

The ureters are divided close to the back of the bladder and freed as required, usually to the common iliac artery on each side. Either No. 1 rubber tubing or No. 12 whistle-tip catheters are then passed up them for about 15 cm. and held in position by firm catgut ligatures. The muscular coat of the lowest part of the sigmoid, regarded as the site of election, is now divided diagonally for one and a half inches from the edge of the mesentery towards the midline on each side at different levels, being lower on the left, and separated freely from the mucosa to make a good bed for the ureter. The mucous membrane at the lowest part of each incision is

then punctured, a small knuckle of the gauze packing is pulled out (fig. 7) and the corresponding catheter or tube is attached to it. The gauze is then withdrawn from the anus and takes with it the attached catheters until the ends of the ureters lie just within the bowel, where they are fixed by a suture passing through all its coats. The ureters are buried by one or two layers of Lembert sutures, some of which catch up their wall, and finally the pelvic peritoneum is sutured in such a way as to cover them completely and fix the intestine.

I will now describe some modifications of the above technique which I have evolved from the experience gained in my series of cases.

Preparation.—I do not irrigate the bowel when the abdomen is opened but rely on a good purge, an enema overnight, another on the morning of the operation and a thorough wash-out two hours before the patient comes to the theatre. Coffey may consider irrigation one of the secrets of his success, but I doubt if it is really of any practical value. If it be required it can be done more rapidly and more effectively with a long rectal tube passed up the sigmoidoscope.

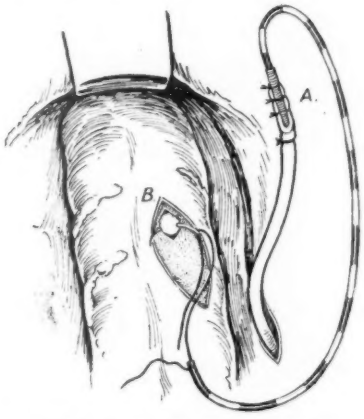


FIG. 7.—Coffey's operation, with tubes or catheters on right side. The left implant is made lower. (*A*) Catheter tied in ureter. (*B*) Catheter being attached to knuckle of gauze.

The site of the transplant (i.e., the site of election) cannot be predetermined, for it is, or should be, controlled by the blood supply of the ureter. The arteries which supply the pelvic portion of the ureter arise from the superior vesical and the middle hæmorrhoidal and are very variable in size, length and position, even differing on the two sides in the same individual (figs. 8 and 9). The spermatic artery (fig. 10) does not seem to give off any ureteric branches below the brim of the pelvis. Mr. A. L. P. Jeffery, Demonstrator of Anatomy at St. Thomas's Hospital, ascertained this for me by injecting several spermatic and internal iliac arteries in the post-mortem room, and the drawings which he kindly made show clearly the variation on opposite sides of the same body.

When the ureteric arteries arise near the brim of the pelvis they can be preserved without difficulty and the transplant can be made into the termination of the pelvic colon, but when they join the ureter near the base of the bladder it may only be possible to save them by a very low and difficult transplant or, as usually happens, they have to be divided. The vitality of the implanted portion of the ureter will

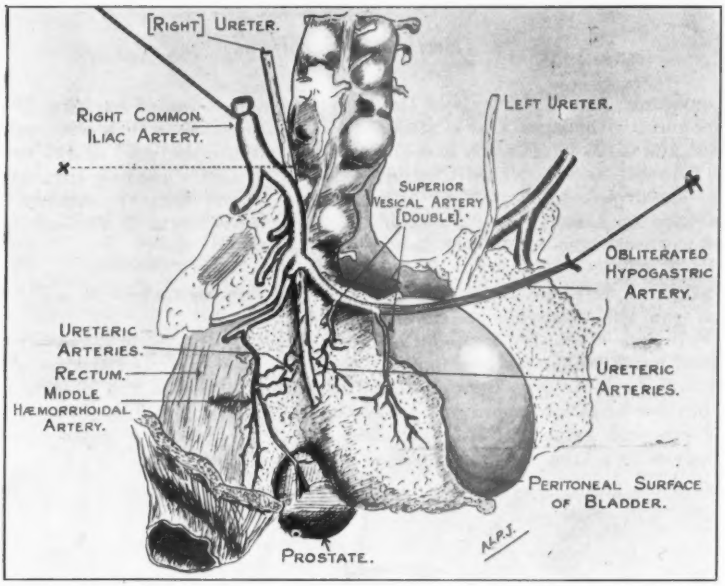


Fig. 8.—Dissection, by Mr. A L. P. Jeffery, of lower ureteric arteries on right side after injection of internal iliac trunk. Injection mass was visible in peri-ureteral vessels as far up as the point marked ×. This was 4 in. above the vesical opening and corresponded in level with the common iliac bifurcation.

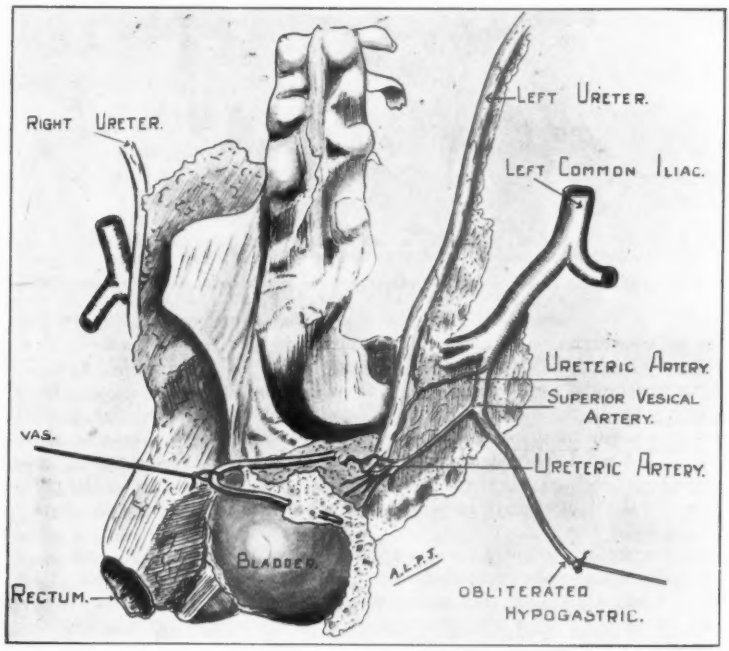


Fig. 9.—Lower ureteric arteries on left side of same subject as fig. 8. Note short ureteric artery springing from the very commencement of the superior vesical trunk.

then be seriously jeopardized and will depend solely upon the extent of the anastomosis with the spermatic branches. This applies particularly to the right ureter, for being further from the bowel than the left, it has to be swung further inwards to make contact, and consequently vessels reaching it low down are always divided. The blood supply of the left ureter is generally safe, for besides being closer to the bowel it is also closer to the middle hæmorrhoidal artery.

I am convinced that sloughing of the implanted portion of the ureter, a not infrequent cause of post-operative death, is due more often to avascularity than to

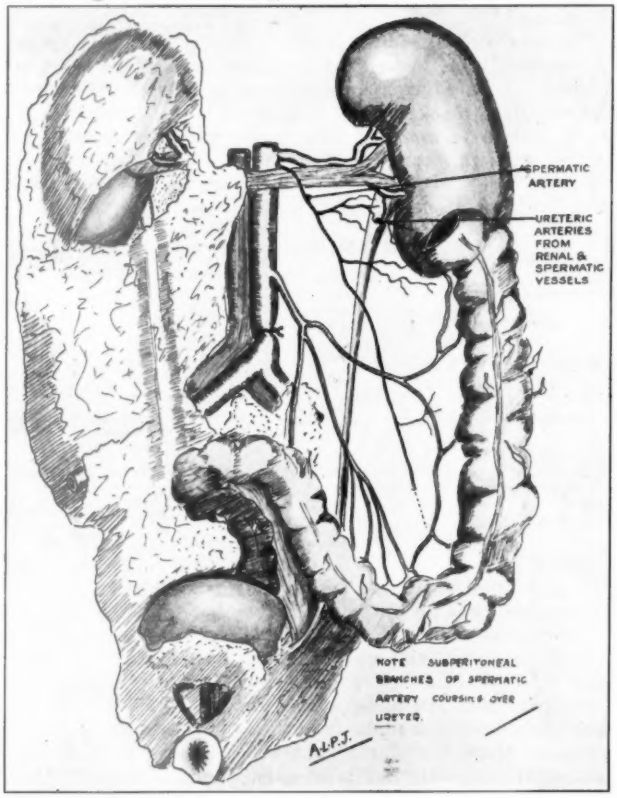


FIG. 10.—Injection of aorta showing ureteric arteries from renal and spermatic vessels which in this subject appeared to supply a very small portion of the ureter.

infection, for it occurred on the right or difficult side in three of the four of my fatal cases which were due to this cause. In two of these the vessels were so short that they had to be divided, and in the third, when preparing the field for transplantation of the left ureter a fortnight after transplantation of the right, the blood supply of the latter was damaged while separating some firm adhesions over the anastomosis. Death took place twenty-four hours later, and at the post-mortem the recent left junction was sound but the terminal $1\frac{1}{2}$ in. of the right ureter had sloughed completely. I have therefore come to the conclusion that if the blood supply of the

lower end of the right ureter cannot be preserved, about an inch of it should be excised, the pelvic colon pulled well over to the right, and the junction made at a higher level than usual.

Mr. Jeffery has suggested that anæmic necrosis may also be caused by spasm of the muscular wall of the intestine and has pointed out that in benign proctitis there is no spasm, but in the true ulcerative form where the muscular wall is invaded, the spasm is so pronounced as to be diagnostic in sigmoidoscopic and X-ray examinations. He makes the helpful suggestion that the injection into the wall of the bowel of a local anæsthetic having a prolonged antispasmodic effect, such as A.B.A., might overcome this danger.

The use of tubes or catheters in the ureters.—Coffey insists on tubes or catheters in bilateral transplantations to prevent compression of the ureters by œdema and extravasated blood. I have given up catheters, as on each of the two occasions I used them they became blocked with phosphates on the fourth and sixth days respectively, and had to be removed with much difficulty by cutting the ligatures with a pair of long scissors through a proctoscope.

For all my other cases No. 0 or No. 1 rubber tubing has been used and, on the whole, has been fairly satisfactory, but great care must be taken not to tie the fixation

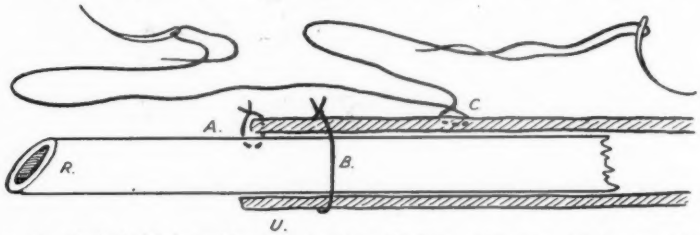


FIG. 11.—Method of fixing rubber tube in ureter. (*R*) Fine rubber tube. (*U*) Ureter. (*A*) Fine catgut suture attaching divided end of ureter to tube but not entering lumen of tube. (*B*) Circular ligature which must not be tied too tightly. (*C*) Stay suture inserted in long axis of ureter to avoid injury to blood-vessels.

ligatures too tightly or the lumen of the tubes will be obliterated. This happened on one occasion and I had to re-open the abdomen six hours later, incise the rectum below each suture line, hook up the tubes, cut the ligatures and apply others. Urine began to flow immediately and the patient made a good recovery, but it is not an experience I wish to repeat, and now I take particular care to see that urine is flowing freely from each tube before it is drawn into the bowel. The method of fixation I now employ is shown in fig. 11.

Even rubber tubes cause trouble and anxiety, for they must irritate the ureter, and if they become blocked, syringing and the passage of wires to remove the obstructing phosphates or mucopus must cause some infection. If tubes become obstructed I think the best plan is to remove them at once either by traction or, if this fails, by cutting the ligature through a speculum.

As the catgut urine guide is so satisfactory in Stiles' operation it ought to be equally satisfactory in the Coffey operation and in my experience of tubes it would be infinitely preferable.

Embedding the ureter.—When performing this operation about four years ago on a woman of 31 it occurred to me that if the bed for the ureter could be made by tunnelling the submucous tissue it would be simpler than incising and suturing the muscular layer. I therefore tried to make a tunnel with a blunt instrument but very soon punctured the mucous membrane and so gave up further attempts. Recently I tried it again in the post-mortem room when it was quite easy, but when

attempted on the living subject, even with a hollow instrument through which air was pumped and a lubricant injected, it proved impossible.

I understand that Cabot and Coffey have had similar experiences. Walker-Taylor's [4] tunnel technique has been most successful in dogs, in which the rectum is firm and thick-walled, but I doubt if it is generally applicable to man, for the walls and mucous membrane of the human bowel are so thin and the submucous tissue so scanty and tenacious that perforation of the mucosa seems unavoidable.

In embedding the ureter by the Coffey method the important points are: (1) complete hæmostasis to prevent compression by clot, and (2) care not to cause strangulation by a tight suture at the point where it enters the wall of the bowel.

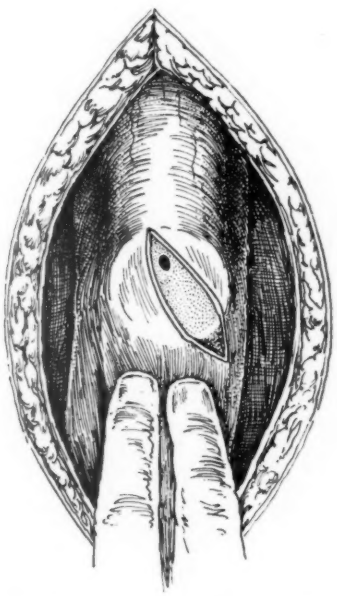


FIG. 12.—Bowel stretched over open end of rectal tube and mucosa punctured.

Drawing the ureters into the bowel.—In my first few cases I followed Coffey's rectal tube technique, in which the ureteric catheter or tube is attached to a tube in the rectum with a suture passed through the opening in the mucous membrane. As this was a weak spot in an otherwise clean operation, for some years I have employed a method which is practically completely aseptic. After the rubber tube is fixed in the ureter, a ureteric catheter is attached to its distal end. A curved leaden rectal tube is then passed by an assistant and guided to the site of anastomosis by the operator's hand within the pelvis. After using it as a support for dividing the muscular layer it is tilted up, and the lowest part of the incised wall of the bowel is so held as to be stretched tightly over its open end (fig. 12). The mucosa is then punctured with a fine knife and the ureteric catheter attached to the ureteral tube passed through the opening into the rectal tube to be caught and

withdrawn by the assistant until the end of the ureter is within the bowel (fig. 13).

The opening in the mucous membrane is made just large enough to take the ureter, so no suturing is required. The stay suture is then passed through the muscular coat and tied (figs. 13, 14 and 15).

Transplantation of one ureter at a time or simultaneous bilateral transplantation depends on the condition and age of the patient and the condition for which the operation is being performed.

For malformations in young children, or as a palliative for inoperable carcinoma in aged and debilitated adults, the two-stage operation is probably safest. When the operation is a preliminary to total cystectomy simultaneous bilateral transplantation is advisable, for the dangers of three operations and the time that must elapse before the cystectomy can be performed, are more to be feared than the slight additional risk of the double operation.

The chief disadvantage of the two-stage operation is the formation of firm and sometimes dangerous adhesions. It was owing to this that I lost what should have been a successful case, for in separating adhesions, the blood supply of a transplanted

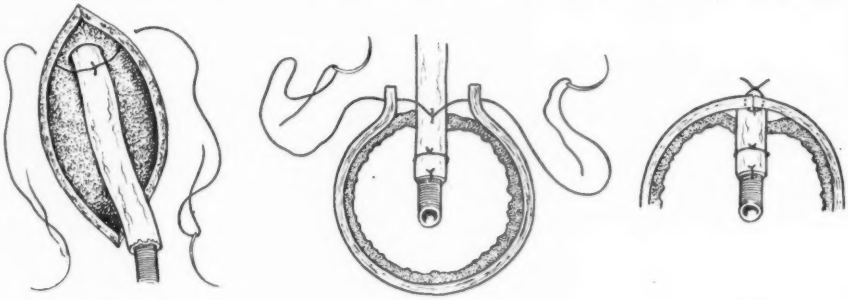


FIG. 13. FIG. 14. FIG. 15.

FIG. 13.—The ureter has been drawn into the bowel and the stay suture passed through the muscular coat on each side of the incision.

FIG. 14.—Oblique transverse section showing ureter after it has been drawn into the bowel and the stay suture passed through the muscular coat.

FIG. 15.—The stay suture tied.

right ureter which had been functioning perfectly for a fortnight, was so damaged that it sloughed. When a two-stage operation is necessary I advise transplantation of the left ureter first, for the disturbance of the intestines and the injury to the peritoneum are less and subsequent adhesions are generally limited to that side. When the right operation is performed first the pelvic colon has an unpleasant way of falling downwards and forwards, and forming with its mesentery an adherent sheet which must be separated before the pelvi-rectal junction can be exposed.

For the delayed fistula operation single transplantation is of course essential.

Renal infections combined with dilatation of the ureters and kidneys are the chief causes of the immediate and late mortality. In nearly all cases there is a transient pyelitis at some period of the convalescence, characterized by pyrexia and renal pain lasting four or five days. This may recur regularly at short or long intervals or there may be little, if any, clinical evidence of its presence, yet it is there, as Coffey [5] has shown by intravenous urography in some of his apparently healthy patients. Out of seven of my patients that were traced, four complained of intermittent renal pain and pyrexia. It is my belief, strengthened by post-mortem records from many sources, that the majority of survivors develop some

form of renal infection which, though silent and unsuspected for many years, ultimately determines their death.

The following is a case in point, and is also, I think, the longest survival recorded :—

R. B., male, aged 38. Trigono-rectal anastomosis for extroversion of the bladder at the age of 16 by the late Mr. H. H. Clutton in 1906. Readmitted to St. Thomas's 22¼ years later with right loin pain of a year's duration and clinical signs of defective kidneys. Prior to this had been in good health and at work. Skiagram showed a large stone filling the right kidney. Blood urea 46. Much pus in urine. The stone, consisting of a mass of phosphatic "mud," was removed on June 29, 1928, and a week later the kidney had to be removed on account of secondary hæmorrhage ; it was small, hollowed out and almost completely destroyed by long-standing sepsis. The wound healed well and the patient left the hospital—only to die three months later from uræmia, 22½ years after the transplantation.

As it is highly probable that one or both kidneys are already more or less damaged in the cases selected for operation, especially those with malignant disease, immediate severe renal infection can be explained by an exacerbation due to operative trauma on the already infected side, and in the case of a healthy kidney by extension along the ureteral lymphatics, but as the lymphatics are sealed when healing takes place and the effects of trauma have ceased, some other cause must be sought for later infections.

Experimentally, regurgitation does not seem possible, for both Grey Turner and Coffey record experiments after death in which fluid could not be made to travel up the ureters even though injected into the rectum with considerable force. And yet in one case both kidneys showed evidence of gross ascending infection (Grey Turner). But conditions in the cadaver are different from those in the living, and therefore it is quite conceivable that, when a diastolic wave in the implanted segment of the ureter happens to coincide with a systolic wave in the rectum, infective material is forced into the ureter and ultimately reaches the kidney in much the same way that a ureteric calculus travels back to the renal pelvis, or else it is carried up by the ascending mucous currents described by Bond [21]. This writer proved conclusively the existence of these currents, for in one case indigo granules placed in the rectum escaped from a cæcal fistula in three days, even though two aperients had been given and there had been a daily evacuation of the bowels ; and in another, indigo granules placed in the bladder escaped from the open mouth of a ureter in the loin. It may be long before the path of renal infections is charted but there seems little doubt that it is an ascending one, for were it hæmic the grossest lesions should be in the parenchyma, whereas pyelitis and its sequelæ are usually found.

Dilatation of the kidney and ureter, either pre-existent or due to post-operative stenosis of the new ureteral orifice, is a potent predisposing cause of infection.

Operative Mortality.

It is difficult to arrive at an estimate of the operative mortality that is of any real value, for in the first place, so far as I can discover, there are only three series of cases besides my own from which to gauge it, and one of these, from the Mayo Clinic [22], includes operations other than transplants and so is misleading for this purpose. Secondly, the mortality depends very greatly on the age of the patient and the condition for which the operation is performed. In young patients with non-malignant lesions, in which renal disease and sepsis are unlikely to be either long-standing or pronounced, and arteriorsclerosis is non-existent, the mortality should not be more than 20% and with more experience and improved technique it should become considerably lower. But in malignant cases, often advanced in years, in which renal sepsis, arteriosclerosis and the local and general effects of the

NON-MALIGNANT CASES. MORTALITY (6 CASES WITH 1 DEATH). 16·6%.

No.	Sex and age	Disease	Date of operation	Unilateral or Bilateral	Result	Present condition or cause of death	Remarks
1	F., 25	Vesico-vaginal fistula	May, 1926	Bi.	R.	Not traced	Technique 2 with rubber tubes. Drained
2	M., 17	Traumatic destruction of posterior urethra and trigone. Suprapubic fistula and cystitis	June, 1926	Bi.	R.	General health poor. Attacks of fever and pain in back	Technique 2 with rubber tubes. No drainage
3	F., 31	Vesico-vaginal fistula	Feb., 1928	Bi.	R.	Well and does all housework	Technique 2 with rubber tubes. Drainage. Ureteral tubes tied in too tightly. Abdomen reopened 6 hours later; ligatures divided and reapplied
4	M., 6	Traumatic destruction of posterior urethra. Perineal urinary fistulæ. Cystitis	July, 1928	Bi.	D.	Shock. P.M.: bilateral septic pyelonephritis	Technique 3
5	F., 40	Vesico-vaginal fistula	Dec., 1929	Bi.	R.	Febrile attacks with rigors and pains in back	Technique 4 with catheters. Drained. Both catheters became blocked on fourth day and were removed
6	F., 53	Recurrent papillomata of bladder following papillomata of ureter and carcinoma of kidney	Jan., 1931	Uni.	R.	Well for 10 months. Later died of metastasis in lungs	Technique 4 with tubes. No drainage. Nephrectomy Rt.—May, 1929 Ureterectomy Rt.—March, 1930 Transplantation Lt.—Jan., 1931 Total cystectomy—Feb., 1931

MALIGNANT CASES. MORTALITY (14 CASES WITH 9 DEATHS). 64·3%.

7	F., 65	Carcinoma of base of bladder. Extensive	Feb., 1927	Bi.	D.	Ninth day. P.M.: abscess at left transplant and long-standing pyonephrosis. Rt. implant healthy; acute ascending pyelonephritis	Technique 2 with rubber tubes. Lt. ureter was infected, greatly dilated and difficult to transplant
8	M., 43	Carcinoma of bladder. Extensive	May, 1928	Bi.	D.	Fifteenth day. P.M.: peritonitis. Rt. ureter sloughing and loose; chronic septic pyelonephritis. Lt. ureter sloughing; renal calculus and chronic septic pyelonephritis	Technique 2 with rubber tubes. No drainage
9	M., 70	Recurrent carcinoma of prostate	Nov., 1928	Bi.	R.	Well for 2½ years. Died of metastasis 3 years after operation. Occasional renal pain	Technique 3 with rubber tubes. No drainage
10	M., 61	Recurrent carcinoma of bladder after partial cystectomy	Dec., 1928	Bi.	D	Third day of asthenia. No peritonitis; transplants sound. Kidneys: Rt. healthy, Lt. metastatic growth	Technique 3 with rubber tubes. No drainage

11	F., 55	Carcinoma of base of bladder	Nov., 1929	Uni.	R.	Unknown	Technique 3 with rubber tubes. No drainage. Rt. kidney functionless owing to ureteral obstruction by extra-vesical growth
12	F., 44	Carcinoma of base of bladder. Extensive	Nov., 1929	Bi.	R.	Died of hæmorrhage from growth 6 months later. Attacks of pyrexia and renal pain	Technique 3 with rubber tubes. Drainage. Urinary fistula on ninth day after escape of tubes
13	M., 54	Carcinoma of base of bladder. Extensive	Feb., 1930	Bi.	D.	Twelfth day. P.M.: both ureters soundly implanted. Lt. pyonephrosis. Broncho-pneumonia	Technique 4 with catheters. No drainage. Both catheters became blocked and removed under anæsthetic on eleventh day
14	F., 44	Carcinoma of base of bladder	Dec., 1930	Bi.	R.	Good health and doing all housework ...	Technique 4 with rubber tubes. No drainage. *Total cystectomy 3 weeks after transplantation*
15	M., 68	Carcinoma of bladder. Extensive. Severe pain. Profuse hæmorrhage	Dec., 1930	Bi.	D.	Third day. Asthenia. No P.M.	Technique 4 with rubber tubes. Drainage. Two ureters on Lt. implanted in separate openings in bowel
16	M., 63	Carcinoma of prostate. Advanced	Jan., 1931	Bi.	D.	Eleventh day. P.M.: peritonitis. Lt. ureter gangrenous nearly to kidney; pyelonephritis. Rt. transplant sound; pyelonephritis	Technique 4 with rubber tubes. Drainage. Lt. tube came away on tenth day with long slough of ureter attached
17	M., 70	Carcinoma of prostate. Advanced	15.1.31 ... 3.2.31 ...	Two stages: Lt. Rt.	D.	Sixteen days after second operation. P.M.: no peritonitis; both ureters soundly implanted and communicated freely with bowel. Lt. kidney atrophied. Rt. septic pyelonephritis. Broncho-pneumonia. Empyema	Technique 4 with rubber tubes. No drainage. No urine from Lt. tube; good flow from Rt.
18	F., 72	Carcinoma of vagina and urethra. Retention. Obesity.	28.4.31 ... 26.5.31 ...	Two stages: Lt. Rt.	R.	Comfort for 4 months then died of cachexia	Technique 4 with rubber tubes. After each transplant bad pain in loin with pyrexia for a few days
19	M., 70	Recurrent carcinoma of bladder after partial cystectomy	7.10.31 ... 21.10.31 ...	Rt. Lt.	D.	Two days after second operation. P.M.: peritonitis from sloughing of terminal 1½ in. of Rt. ureter. Kidneys healthy	Technique 4 with rubber tubes. No drainage. Blood supply of Rt. ureter injured when separating adhesions for Lt. transplant
20	M., 68	Carcinoma of prostate. Advanced	Dec., 1931	Bi.	D.	Seventh day. P.M.: no peritonitis. Intramural portion of Rt. ureter sloughing. Septic pyelonephritis Rt. and Lt.	Technique 4 with rubber tubes. No drainage. Both tubes became blocked and were removed on fifth day

Note.—Technique 2. Coffey method. Ureteral tubes attached to rubber rectal tube
Technique 3. Coffey method. Ureteral tubes caught with forceps passed up sigmoidoscope
Technique 4. Coffey method with writer's modifications

neoplasm are all against the operator, the mortality is undoubtedly high and ranges from 30% to 60%.

The following figures are valuable for comparison, but it would be foolish to regard them as anything but approximate.

GREY TURNER (Stiles' operation in two stages for malformations).
17 cases with 4 deaths ... 23·5%
Ages from 1 to 22 years
Average age 8

MAYO CLINIC (Coffey operation with catgut urine guide in two stages for malformations).
66 cases with 18 deaths ... 13·6%
Not a true mortality for the operation as some were not transplants.

COFFEY. (Simultaneous bilateral).
Non-malignant. 18 cases with 2 deaths ... 11·0%
Ages 1 to 46 years
Average age 20
Malignant. 17 cases with 5 deaths ... 29·4%
Ages from 28 to 70 years
Average age 51

NITCH. (Coffey operation. Mostly simultaneous bilateral).
Non-malignant. 6 cases with 1 death ... 16·6%
Ages from 6 to 53
Average age 30
Malignant. 14 cases with 9 deaths ... 64·3%
Ages from 40 to 72
Average age 60

Note.—After this paper was read the author found a very interesting paper by Waltman Walters [23] of the Mayo Clinic in which the mortality of transplantation for exstrophy of the bladder is far lower than in any series that have been published hitherto.

WALTMAN WALTERS (C. H. Mayo operation with catgut urine guide, i.e., Coffey principle without catheters, in two stages for exstrophy).
76 cases with 3 deaths ... 3·9%
Ages from 2½ to 34 years

The causes of death peculiar to the operation are:—

(i) Operative peritonitis, a complication which should not occur if the aseptic technique I have described is employed.

(ii) Peritonitis from sepsis at the site of transplantation, due to ascending infection or to leakage.

(iii) Sloughing of the ureter.

(iv) Various forms of chronic or acute renal infection.

The operation undoubtedly has a high mortality due to both technical and constitutional causes, but as it is intended to relieve physical and mental distress, and in suitable cases of malignant disease to permit of complete removal of the neoplasm, I consider it is justifiable, no matter how high the mortality, when it brings relief and comfort to the survivors.

(A tabulated summary of the writer's cases is given on pp. 42, 43.)

REFERENCES.

[1] STEINKE, *Univ. Penna. Med. Bull.*, 1909, xxii, 110. [2] PETERSON, *Journ. Amer. Med. Assoc.*, 1901, xxxvi, 569. [3] COFFEY, *Journ. Amer. Med. Assoc.*, 1911, lvi, 397. [4] WALKER-TAYLOR, *Aust. and N.Z. Journ. of Surg.*, 1931, i, 158. [5] COFFEY, *Brit. Journ. Urol.*, 1931, iii, 353. [6] SIMON, *Lancet*, 1852 (ii), 568. [7] SMITH, *St. Bart's. Hosp. Reps.*, xv, 1879. [8] TRENDELENBURG, *Verhand. der Deutsch. Gesellsch. f. Chir.*, 1895, xxiv, 132. [9] BOARI, *Ann. Mal. Gen. Urin.*, 1896, v, xiv, 1-25. [10] TUFFIER, *Rev. de Chir.*, 1898, viii, 281. [11] REIN, *Centralb. f. Gynakol.*, 1894, xviii. [12] CHALOT, *L'Indépendance Med.*, 1896, 297. [13] KRYNSKI, *Centralb. f. Chir.*, 1896, xxiii, 73. [14] MARTIN, *Journ. Amer. Med. Assoc.*, 1899, xxxii, 159. [15] FOWLER, *Amer. Journ. Med. Sci.*, 1898, cxv, 270. [16] LENDON, *Brit. Med. Journ.*, 1906 (i), 961. [17] PETERS, *Journ. Amer. Med. Assoc.*, 1899, xxxiii, 669. [18] STILES, *Surg. Gynec. Obst.*, 1911, xiii, 127. [19] GREY TURNER, *Brit. Journ. Surg.*, 1929, xvii, 114. [20] COFFEY, *Surg. Gynec. Obst.*, 1928, xlvii, 593. [21] BOND, *Brit. Med. Journ.*, 1905 (ii), 232. [22] MAYO and HENDRICKES, *Surg. Gynec. Obst.*, 1926, xliii, 129. [23] WALTMAN WALTERS, *Amer. Journ. Surg.*, 1932, xv, 15.

Discussion.—Mr. P. N. WALKER-TAYLOR: In the course of his paper Mr. Nitch made reference to my research work on this subject. For two years I was engaged in research work in the Department of Urology at the Royal Prince Alfred Hospital, Sydney, and in respect of this particular problem I performed operations on 77 dogs, with the implantation of 106 ureters. I commenced by following Coffey's techniques 1 and 2. A high mortality resulted, death being due, in many instances, to peritonitis, in others, of course, to pyelonephritis and hydronephrosis. In my experience of these cases, pyelonephritis arising in a normal kidney rarely, if ever, results without demonstrable obstruction to the ureter. Peritonitis arose from leakage of infected material between the stitches.

It seemed obvious that if incision and resuture of the intestinal muscle and peritoneum could be avoided, whilst the principle of submucous transplantation was still retained, a definite improvement would be effected. It was conceived that burrowing a longitudinal tunnel in the submucous layer of the bowel would comply with these two conditions. After many modifications I finally arrived at what I called the "aseptic irreversible tunnel technique." The ureter is cut and the end split. A silk ligature is affixed to the split end, and the other end of the silk is tied to the piercing instrument. The bowel is taken in the left hand and a small transverse incision is made into the muscular layer at a spot which becomes the proximal end of the tunnel. The tunnel is now made with a blunt dissector, the type I employed being McCormick's. By a stroking motion of the tip of the instrument the mucosa is by degrees pushed away from the muscle for the required distance. A straight metal tube is inserted up the rectum by an assistant to the distal end of the blind tunnel, where it is held through the bowel wall with the left hand. The piercing instrument is now introduced into the tunnel and its tip makes a tent of the mucosa at the distal fundus, which is inserted into the end of the rectal cylinder. The piercing instrument is pushed through the mucosa and down the tube. Thence it is gradually drawn from the rectum by an assistant until the silk and finally the ureter enters the tunnel. The ureter is allowed to project within the bowel lumen and is anchored by one stitch at the proximal end of the tunnel and again by the terminal silk ligature outside the anus. In dogs the fashioning of the tunnel is a very simple matter, but on account of their small ureters I found the employment of ureteral catheters ill-advised.

Taking into consideration that the experiments were performed on dogs, and recognizing the elementary fact that the smaller the ureter the greater the risk of obstruction, the results were satisfactory. While using the above technique, i.e. in thirty-four consecutive operations, there was not one case of peritonitis arising from the implantation site, nor was there a single death from acute pyelonephritis.

Omitting uncontrollable causes, such as pneumonia and gangrenous wounds, the cause of death in the unsuccessful cases of this series was hydronephrosis and pyonephrosis, at variable times after the operation up to five months. The obstruction in these cases always lay at the cut end of the ureter, which had contracted. This phenomenon, in experimental work at least, was the final problem that remained, and is the feature that must be carefully watched for many months after Coffey's transfixion suture technique.

Mr. Nitch considers sloughing of the ureter to be due to avascularity. I have only seen this phenomenon when catheters were employed. In each case it was thought that too large a catheter had been used for the size of the ureter.

Clinically I have performed this operation on one patient, a youth, aged 20, who had an ectopic bladder. I transplanted the right ureter into the rectum. In spite of the contracted pelvis the rectum pulled up easily and the operation proceeded according to plan. After about ten days or a fortnight the rectal urine began to be scanty, and the patient's temperature fluctuated. Through a sigmoidoscope I saw an inflamed and swollen ureteral papilla. This I nipped off, and the patient was soon passing up to fifty ounces of rectal urine daily. Uroselectan showed the kidney to be functioning well. Five weeks after the first operation I opened the abdomen to transplant the left ureter. Owing to the right transplant the rectum could not this time be well mobilized, and in attempting to fashion the tunnel, the mucosa was early perforated. I then completed the operation after the fashion of Stiles. Unfortunately there was leakage and the patient died from peritonitis. In view of the state of affairs, the left ureter should have been transplanted into the pelvic colon.

In reference to Coffey's transfixion suture technique—an undoubtedly brilliant concept—Mr. Nitch has suggested that with a thickened ureter such as is often encountered in these cases, the rectal mucosa would cut through long before the ureter. To avoid this I suggest a modification: Include in the transfixion stitch a small metal ring in the rectum

on which traction could be made to ensure cutting through the ureter. I doubt whether Coffey's transfixion suture technique is practicable for carcinoma of the bladder. Advanced carcinoma of the bladder is almost always accompanied by definite renal infection. Infecting organisms and lowered tissue resistance of a certain degree are already present in the kidneys, and under these circumstances to tie-off a ureter for a matter of days, and thereby add the potent factor of stasis, is, in my opinion, compounding all the elements of a first-class pyelonephritis. For this reason, it is my contention that further observations must be made before Coffey's transfixion suture technique can be recommended for carcinoma of the bladder or other conditions where infection is present in the kidneys or ureters.

Mr. W. H. OGILVIE : I would like further information upon one point—why the operation continues to be performed by urologists. It would appear that the technical difficulties are considerable, the risks out of proportion to the benefits to be expected, and success rarely enduring. Much ingenuity has been expended in overcoming the difficulties that are of your own choosing, and in attempting to solve problems that are by their nature insoluble.

The majority of these operations have been performed for incurable conditions, in which the prospect of life was one of a few months only. Is there justification, under such circumstances, for a procedure whose primary mortality, in cases of carcinoma, seems to vary between 20% and 60%, and which leads, in many of those that survive, to an ascending infection of the kidneys which cannot be combated. It may be doubtful by what mechanism infection reaches the kidneys, but its first cause is the implantation of the ureters into a highly infected area. When for any reason a fistulous communication occurs between the colon and the bladder, infection of the kidneys inevitably follows, even though the normal mechanism guarding the ureteric orifices is intact. It appears inevitable when there is no such protection. In the operation of transplantation an attempt is made to prevent infection by the formation of a valve, which is claimed to be a reproduction, in the colon, of the ureteric orifice in the bladder. The valve, however, is a mechanism rarely employed in the body, and then only in the circulatory system. All the other "valves" have been shown in turn to be sphincters, and it seems probable that the emptying of the ureter is like that of the stomach and ileum, and the ureteric orifice akin to the pylorus or ileocæcal sphincter. A valve in any case is only efficient against pressure, and the tests that have proved the success of the uretero-colic valve have been pressure tests. The large intestine is inert over the greater part of the day, and an interchange between the two tubes must then be possible.

I bring up this question because, in the only case of total cystectomy I have been called upon to perform, I used the method of transplanting the ureters into the skin, which I had seen successfully employed by Nordenboos of Amsterdam. The technique of this operation is very much easier than that we are discussing. Peritonitis is impossible, because the peritoneum is not opened and the colon not touched ; the subsequent cystectomy is also very much easier in an abdominal cavity free from adhesions. The ureters discharge upon a clean surface, and should attacks of pyelitis occur, as they may after any form of transplantation, they are easily dealt with by irrigation. After ureto-colic transplantation there is no means of treating such attacks except by drugs. Finally the patient's comfort is, I imagine, much greater after Nordenboos' operation than after transplantation into the bowel. In place of liquid motions passed at frequent intervals, he has a perfectly efficient apparatus like that used for a permanent suprapubic opening, and his equanimity is only limited by the size of the bag.

Mr. BERNARD WARD: My experience with Coffey's simultaneous transplantation of both ureters extends to four cases of growths of the bladder and all were performed by the No. 2 technique, with tubes.

The first case was a patient with only one ureter, the other kidney and ureter having been previously removed on account of a growth. The transplantation of the ureter was followed by total cystectomy three weeks later. The patient subsequently lived five years in perfect health, until secondary growths carried him off. At the autopsy the kidney was found to be healthy macroscopically and microscopically, except for a few small secondary nodules. The ureter was not dilated. Specimens from this case were shown before the Section at the end of last year.[1]

The second patient was a woman over sixty, in the last stage of advanced cancer of the bladder, and the operation was performed with the idea of giving her relief during the few

1 *Proceedings*, 1932, xxv, 540 (Sect. Urol. 14).

remaining weeks of her life. She survived for six weeks, with complete relief from pain and hæmorrhage, and then died from exhaustion. The autopsy disclosed a mild infection at the site of implantation of the right ureter, with some mild peritonitis around, and also infection of the right kidney. The left ureter was not dilated, and the kidney was healthy.

The third case, like the first, was followed in three weeks by total cystectomy, for multiple growths. The patient is alive and well to-day, eighteen months after his operation, and is in perfect health. The blood urea has been constantly tested and is always between 40% and 50%. He has not had any pain in the back, or febrile attacks, and is at work as a labourer.

The fourth case was in a woman with advanced carcinoma of the bladder, invading the anterior vaginal wall, and the transplantation was intended as a preliminary to cystectomy. However, peritonitis developed and the patient died on the eighth day. At autopsy the last three-quarters of an inch of the right ureter were found to be gangrenous and there was widespread peritonitis around. The right kidney was full of pus. The left kidney and ureter and the site of implantation in the bowel were healthy.

One may summarize these results as follows: Seven ureters were transplanted, of which five were entirely successful, there being no dilatation of the ureter, or infection of the kidney. Two were unsuccessful, and in these there was infection at the site of implantation, and also infection of the kidney. Both were on the right side, and in view of what Mr. Nitch has just told us with regard to the blood supply of the lower end of the right ureter, and the ease with which it may be disturbed, it is possible that this was the cause of the bad result in these cases. My results seem to suggest that if one can successfully make an anastomosis in the bowel wall without getting any infection of the wound, one is likely to get a successful result by Coffey's method. I look upon these results as extremely encouraging.

I should like to ask Mr. Nitch if in his view Coffey's No. 1 technique, without tubes, would be likely to be successful if used for simultaneous transplantation of both ureters? Coffey says that it is invariably fatal in dogs, and for that reason has never tried it in man, but it has been used most successfully for transplantation of the ureters in two stages, and there are so many advantages associated with it that if further experience proves it to be feasible for simultaneous bilateral transplantation, it is likely to be the operation of the future.

Mr. E. W. RICHES said that he had been impressed by the advantages of Mr. Walker-Taylor's aseptic-irreversible-tunnel technique and had tried to apply it to human beings. In the post-mortem room he had been able to form a tunnel fairly easily, but had found an instrument rather sharper than a blunt dissector to give the best results. In the living subject it was impossible to tunnel with certainty for more than half an inch before piercing the mucous membrane, but it was possible to combine the Coffey and Walker-Taylor technique without losing the advantage of the latter, by making a 1½-in. incision through the peritoneal and muscular coats of the bowel and tunnelling for the final ½ in. For this purpose he had employed a single instrument both for tunnelling and piercing; it was a 9-in. straight trussing needle with the point ground down and flattened to give a thin blade with a fairly sharp cutting edge; the rubber tube was slipped over the blunt end of the needle and fixed by a stitch through the eye; the needle was passed into a sigmoidoscope introduced by an assistant and drawn down, the tube and ureter following. This had the additional advantage of ensuring that the ends of both tube and ureter were closed in transit through the bowel lumen.

He had operated on two patients by this method, doing bilateral transplantation at one sitting; both were cases of carcinoma of the bladder base. In one the left transplant was successful but the right was too direct and an ascending infection ensued; as the left kidney was fibrotic and functionless, the patient died. In the second case, that of a woman aged 55, both transplants were successful and a total cystectomy was performed one month later. The patient was now well and comfortable three months after operation. He did not allow her to hold her urine for more than three hours, and this she was able to do easily.

He felt that the comfort of the patient was much greater after successful transplantation into the bowel than on to the skin surface.

He had found difficulty in using a straight sigmoidoscope during the operation as the patient had to be moved to the end of the table, and he asked Mr. Nitch if this could be avoided by the use of his malleable tube.

Mr. T. J. MILLIN said that he found it difficult to believe that the cause of the occasional sloughing of the lower end of the ureter after colonic implantation was, as Mr. Nitch suggested, the result of an interference of the blood supply, due to sectioning of the small ureteric branches of the superior vesical artery, etc. In practice, it was well-nigh impossible to avoid them, yet sloughing only occasionally resulted. This accident did not follow skin implantation. Moreover, in some spastic conditions, extensive stripping of the ureter had been employed, certainly interfering with this vascular supply, yet sloughing had not resulted. It appeared to him that the phenomenon depended on undue tension leading to a relative ischæmia, and so predisposing to a direct infection from the intestinal lumen.

He agreed with previous speakers that skin implantation was preferable in malignant cases, but that the colonic technique was that of choice for benign conditions where the expectation of life was reasonably long.

Mr. NITCH, in reply, said that his own experience of tunnelling the bowel had convinced him that the Walker-Taylor operation could seldom be carried out successfully in man. Bilateral ureterostomy, referred to by Mr. Ogilvie, was, in his (Mr. Nitch's) opinion, an unsatisfactory operation, especially for a young adult; it was attended by great mental and physical discomfort, and was no more free from the danger of ascending infection than was recto-sigmoid transplantation. Most patients could retain urine after the latter operation for about three hours during the day, and from seven to eight hours at night. Abdominal adhesions did not affect the subsequent cystectomy, as it was, or should be, an extra-peritoneal operation.

He congratulated Mr. Bernard Ward on his success in the two cases of total cystectomy, and considered that such results fully justified risking the dangers of transplantation. Coffey's No. 1 operation without tubes should always be in two stages, for in the few cases in which it had been employed for simultaneous bilateral transplantation, all the patients had died.

United Services Section.

President—Lt.-Col. E. M. COWELL, D.S.O., R.A.M.C. (T.A.).

[*April* 11, 1932.]

Scarlet Fever: An Effort in Preventive Medicine.

By Surgeon Commander W. H. EDGAR, M.D., R.N.

THIS paper is an account of an effort in preventive medicine carried out at one of the Royal Naval Training Establishments. It lays no claim to any new research and is merely the account of the application of existing knowledge to an easily controlled community.

H.M.S. "St. Vincent," despite its name, is a shore depôt at Gosport, in the Portsmouth Command. It was formerly the headquarters of a Division of the Royal Marine Light Infantry and was converted to its present use in 1927. It covers a large area, and the buildings, consisting of dormitories, mess rooms, schools and technical instruction rooms, are all well adapted to their purposes. There are ample playing-fields and two swimming baths, so that the place resembles a large public school in its lay-out.

The personnel consists of about 600 boys destined for the seaman branch of the Navy. They join in batches of twenty-five every three weeks, arriving as raw youths from various parts of the country. The age of joining is 15¼, and the average time that a boy spends in the Training Establishment is one year, after which he is drafted to a sea-going ship.

A collection of youths of this age is somewhat explosive material in the matter of the infectious diseases, and the prevention and limitation of these diseases is one of the chief anxieties of any medical officer in charge.

Infectious diseases.—The majority of the infectious diseases, such as measles, mumps, chicken-pox and rubella, do not lend themselves to any specific preventive measures, but much can be done by constant medical inspections, frequent temperature taking, prompt isolation of suspects and contacts, and adequate attention to the periodic cleansing of articles communally used, such as bugles, telepads, and school utensils, to say nothing of those broader measures of hygiene coming under the headings of feeding and ventilation.

With scarlet fever and diphtheria we are on different ground, for we have more specific weapons in the Dick and Schick tests, which enable us to estimate our patients' immunity to these diseases and to take appropriate measures in susceptible cases.

When I took over medical charge of the "St. Vincent" I looked through the records and sick returns, and I found that diphtheria was almost absent, though it had occurred from time to time in another similar establishment in the port; scarlet fever, on the other hand, was persistently present. It seemed to occur every term and to blaze up now again into a small epidemic. A campaign against scarlet fever was therefore evidently desirable, particularly when one remembered its common complications of nephritis, otitis and endocarditis.

The campaign.—As a first step all short leave was stopped for the first three weeks of term so as to isolate the establishment from the outside world. Ordinarily the boys were allowed out on Wednesdays and Saturdays and it seemed probable

that the endemicity of scarlet fever was due to infection acquired at cinemas, theatres, etc. During these three weeks I conducted an intensive search for possible carriers and examined all boys and instructors who had ever had scarlet fever, and on finding a boy who had had the disease shortly before joining and who was suffering from a profuse and unreported discharge from one of his ears, I was filled with hope. I sent him to Haslar for a bacteriological examination and then isolated him pending the result. He was found to be a carrier, but alas, of diphtheria not of scarlet fever! The strain of Klebs-Loeffler bacillus must have been very mild in this case, for we got no cases from him.

The next step was to institute the Dick test as a routine, but as expense would be involved I applied for Admiralty approval. This was given with the proviso that the consent of the boys' parents or guardians should be obtained in all cases. For this purpose I drafted a letter explaining the reason for the Dick test in simple language and requested consent for it to be carried out, together with any subsequent safeguarding procedures which might be found necessary. This correspondence was rather a trouble—and, incidentally, the postage amounted to as much as the cost of the Dick procedures themselves—but I was well repaid by some of the replies. Consent was always given.

It might have seemed rational to test all the boys right away, but it did not appeal to me as a medical procedure as it would have interfered with the work of the establishment, and two or three hundred boys might have required prophylactic inoculation, in which case the occurrence of a number of reactions would have brought disrepute on the whole scheme. As an alternative I tested the boys as they joined in their batches of twenty-five and I estimated that by the end of 1931 all the boys then serving in the establishment would have been tested; this proved correct.

The Dick test.—This consists in the injection into the skin of the forearm of 0·2 c.c. of scarlet fever toxin; it is in the nature of a non-immune phenomenon and indicates whether there is any antibody to the scarlet fever toxin circulating in the blood. It is simple to perform and the only technical faults likely to occur are that the injection may be given hypodermically rather than truly intradermically, or that, owing to the very small quantity required, some of the solution in which the needle of the syringe may have been resting may be injected instead of the toxin. These faults can be easily guarded against. When the injection is made properly a small wheal is raised, exactly like that from a recent mosquito bite.

The result of the test is read in twenty-four hours and a good natural light is advisable. When positive, an area of erythema surrounds the puncture. This erythema is a distinct blush extending for about an inch around the site of injection, and must not be confused with the smaller and more intense redness which sometimes occurs owing to the extravasation of blood immediately in the vicinity of the prick. The makers of the test solutions supply a detoxicated control solution, and they recommend that it should be injected into the other arm to differentiate between the specific reaction due to the scarlet fever toxin and the non-specific "pseudo-reaction" which may occur in individuals susceptible to any foreign protein. This control is not so necessary with the Dick test as with the Schick, and after some experience in reading results it can be dispensed with.

This test enables us to separate those who are immune from those constituting potential cases in any community, and I have found that about 20% of the boys who join the "St. Vincent" give positive Dick reactions and are therefore non-immune to scarlet fever.

The non-immunes are placed on the scarlet fever prophylactic list and are given a course of inoculations intended to produce active immunity.

There are two methods of producing this immunity artificially: (1) The passive, by the injection of one dose of anti-sera, but this only gives about ten days'

immunity. It is very useful when an unexpected case of scarlet fever occurs in a small community such as a ward, but it is of no use for producing the lasting immunity to be aimed at in larger and more permanent communities. (2) The active, in which a course of injections raises the resistance by the production of antibodies.

With scarlet fever vaccine the dosage is by skin test doses; I usually begin the prophylactic course with 500 skin units, and proceed in weekly doses of 1,000, 5,000, and 10,000, so that the course of four injections takes a month. A local reaction in the form of a sore arm is not uncommon, but general reactions are rare in my experience and I have only had four cases, with a total of fourteen days' sickness, in 667 injections.

One satisfactory thing about these prophylactic injections is, that one can prove that one has achieved something, by repeating the Dick test and finding that the reaction has changed from positive to negative. I have not made this a routine, but I have done so in cases selected haphazard at varying times after the prophylactic course in order to discover the duration of the immunity. All remained negative up till eleven months and then, in one case only, there was a slightly positive result again, but it is generally thought that the immunity lasts from eighteen months to two years, though this probably depends to some extent on the amount given during the prophylactic course. The doses I give are on the medium side, but I am satisfied that they are large enough to ensure an immunity for about a year—that is, the time a boy spends in the "St. Vincent"; for, at sea, the chance of his contracting the disease is much lessened.

Up to the end of 1931, 865 boys had been Dick tested, of whom 177 (about 20%) were found to be positive (non-immune). The prophylatic course was given to 168 boys, entailing 667 individual injections.

Cost.—When bought at contract prices and there is no wastage, the Dick test costs a penny per head. The prophylactic course costs about half a crown per head—an insignificant sum compared with the cost of nursing a case of scarlet fever. When the test and prophylactic solutions are purchased at retail prices the above costs are doubled. These solutions do not retain their valency for long, and the Dick solution should be used within a month of issue.

Results.—The immunization of all the boys in the establishment had not been achieved until the end of 1931, and as the figures which I shall give refer to that year, they should not be taken as a final estimate of the efficiency of the measures.

The following two facts, however, are being still further strengthened by my experience during the present year.

(1) The incidence of scarlet fever in the "St. Vincent" for 1931 was 10 per 1,000 as compared with 47·5 per 1,000 for the three previous years that the establishment had been going, and in one of these years the rate was 90 per 1,000; and (2) that scarlet fever is definitely less infectious amongst the boys, and when it does occur is as sporadic cases rather than in small epidemics.

During the summer term of 1930 before anti-scarlet fever measures were taken, there were seven cases—really a small epidemic due to infection from the original case, whilst in the same term in 1931 there were two cases, and as far as I could ascertain, these boys had not been in contact with each other.

As these occurred in the same week, the boys were probably infected from a common source ashore. The interesting feature is that neither case caused any infection of room or class-mates, thus suggesting that the infectivity of the disease had been reduced in an immunized community.

That the "Dick positives" are indeed our potential cases is borne out by an incident which happened towards the end of last year. A boy was found to be positive, but owing to a leave period the prophylactic course was postponed until his return. It was then too late; he contracted the disease ashore and developed it

on the second day of his return; in this case too, however, his messmates were not infected.

Boys who have had scarlet fever invariably give a completely negative Dick test.

What is the relation between these anti-scarlet fever measures and cases of scarlet fever which occurred in 1931?

There were six cases. Two had been recorded as slight or pseudo-reactions and in consequence did not have a prophylactic course. From my experience I now read all doubtful cases as positives, and I am sure this is the best course when preventive measures are at stake.

One case was positive to the Dick test but had not been given a prophylactic course because Admiralty approval had not been received before he contracted the disease.

Two boys had given a negative Dick reaction and logically should not have had the disease. They were probably technical failures in the performance of the test as they occurred early in my series.

One boy was a "positive" and had had a prophylactic course in March. He contracted the disease in an aberrant form in July, and there was some doubt about the diagnosis, but the hospital authorities decided, for safety, to treat the case as one of scarlet fever.

This question as to how far the prophylactic measures modify the diseases when they do appear is still being threshed out in the case of small-pox and vaccination, and I believe also occurs with regard to diphtheria. Unrecognized cases of infectious disease occurring in a susceptible community constitute a serious matter, involving difficult ethical questions about immunizing procedures in general, but it is one which need cause no anxiety when dealing with an immunized community such as that in H.M.S. "St. Vincent" in the case of scarlet fever, for here the definite gain in reduced incidence of the disease and the invaliding therefrom, overbalances other considerations.

Conclusion.—While it may not be possible entirely to purge scarlet fever from amongst a large collection of youngsters living in close proximity, it would appear that its incidence can be lessened, and what is more important still, the disease can be reduced to an almost non-infectious one, as the result of the building up of a communal immunity.

Sporadic cases will undoubtedly occur from time to time, owing to heavy infection or to lowered resistance in the individual; indeed, the Doctors Dick themselves only claim a 95% efficiency for their measure.

Section of Epidemiology and State Medicine.

President—Professor M. GREENWOOD, F.R.C.P., F.R.S.

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Puerperal Fever and Puerperal Pyrexia.

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AN important discussion on "The Notification of Puerperal Sepsis," held in November, 1924, by the Section of Obstetrics and Gynæcology, with the Section of Epidemiology and State Medicine, and the Society of Medical Officers of Health,[1] was the forerunner of administrative action.

As this paper is concerned with some results of the measures which have since been adopted, it may be prefaced by a brief outline of the specialist and administrative views then expressed, most of which were subsequently translated into Government regulations. Some of the points raised at the meeting referred to may be summarized as follows: Notification of puerperal fever in most areas was, for many reasons, most unsatisfactory, hospital beds were insufficient, while patients were often sent too late for treatment to be of value; notification to be effective should be "a means to an end," and should be followed by practical measures of benefit to the patient and helpful to the medical practitioner, such as specialist advice, hospital treatment, home nursing, bacteriological services, as the case might be; an important preventive step would be taken if notification were made wide enough to embrace early and suspect cases to be included under a new term, puerperal pyrexia (which the Sub-Committee of the Section of Obstetrics and Gynæcology had defined as "rigor or temperatures of 102° F., or over for twenty-four hours"). With regard to notification of puerperal fever as such, two relevant extracts from the discussion may be given. The Chairman, Dr. Russell Andrewes, quoted Dr. Fothergill as saying that "in 1911-14 out of 204 areas, in 93 the total of deaths from 'puerperal fever' was larger than the total of notifications." On the other hand, Sir John Robertson pointed out that in Birmingham "there were last year . . . about five and a half cases to one death," which he attributed to the fact that the amount of hospital accommodation had always been sufficient. Local experience, therefore, as regards notification of puerperal fever, varied considerably.

Since then the position has materially changed, and it is now possible to examine the results which have so far followed the practical application of these suggestions. In August, 1926, the Ministry of Health in England made regulations requiring the notification of all cases of puerperal pyrexia (in addition to puerperal fever) as from October 1 of that year, and laid upon local authorities the duty of making administrative provision for specialist advice, hospital or home treatment, and bacteriological services, as suggested above. On October 1, 1929, similar regulations were promulgated for Scotland. The general effect of these regulations has been greatly augmented by the wide publicity given to the problems of maternal mortality and morbidity in general, as well as by the current inquiry into maternal deaths. It may, therefore, be useful to inquire into the results of the administrative measures adopted in recent years, especially as the efforts of local authorities to control

[1] *Proceedings*, 1925, xviii (Sect. Obst. and Gyn.).

puerperal sepsis have apparently not met with success, as judged by the stationary—or even rising—death-rates from this cause.

For this purpose, I propose to discuss the more recent influences which have been brought to bear on the incidence, mortality and treatment of puerperal infection, using as an illustration our local experience in a large industrial city. The general position is that administration is now much better informed as to the material facts. In this respect the puerperal pyrexia regulations have assisted the ascertainment of the volume and distribution of infection, while death certification has become more accurate. Associated with this, a greatly extended use has been made of facilities for hospital treatment. These influences have combined to bring administration within a measurable distance of realizing the full extent of the problem, though it is certain that the real incidence of puerperal infection in its milder forms is not yet known. The experience of the past few years has shown that, the more the actual facts become disclosed, the higher become the rates of incidence and of mortality. This, at any rate, is the experience in Glasgow (which is, of course, not unique), and the question arises to what extent the specific measures suggested in 1924, and since adopted, have succeeded or failed. This involves a careful assessment of several factors, and an effort has been made to ascertain, as accurately as possible, the main epidemiological features of puerperal infection, its incidence and fatality in relation to the administrative measures which have been put into operation. The following account is based largely upon (*a*) an analysis of notified cases of puerperal fever and pyrexia; (*b*) an inquiry into 200 consecutive deaths—both undertaken by Dr. John Walker, Public Health Department, Glasgow; and (*c*) a special epidemiological, clinical and bacteriological investigation, by Dr. Margaret Thomas, of 800 cases admitted to Belvidere Fever Hospital.[1] Before entering on this, certain aspects of maternal mortality and of the part played by puerperal sespis are considered.

Mortality rates.—The maternal mortality rate per 1,000 births for Scotland has stood for many years at a higher level than that for England and Wales, while the rate for Glasgow is higher than either. The following table, taken from the returns of the Registrars-General, shows the trend for the past ten years:—

TABLE I.—MATERNAL DEATHS PER 1,000 BIRTHS.

	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
England and Wales ...	3·91	3·81	3·81	3·90	4·08	4·34	4·11	4·42	4·33	4·40
Scotland	6·38	6·59	6·42	5·82	6·16	6·40	6·43	6·98	6·87	6·95
Glasgow	6·39	7·60	7·08	5·84	7·63	6·68	7·21	8·79	8·33	8·57

This table reveals substantial differences in the mortality rates as between England and Wales, Scotland and Glasgow. Further, the upward tendency is greater in Scotland, and greatest in Glasgow. Taking the figures for the last two quinquennia, 1921-25 and 1926-30, the respective rates for puerperal sepsis, abortion, and other maternal causes, were as follows:—

TABLE II.

	1921-1925			1926-1930		
	England and Wales	Scotland	Glasgow	England and Wales	Scotland	Glasgow
Puerperal sepsis	1·401	1·873	2·488	1·751	2·137	2·672
Abortion	0·131	0·408	0·428	0·115	0·399	0·654
Other maternal causes ...	2·369	4·003	3·994	2·454	4·186	4·588
Total rates ...	3·901	6·284	6·910	4·320	6·722	7·905

These tables are intended to show the position which the city occupies in relation to the national statistics of mortality. The total mortality rates, and those for sepsis, reveal an upward tendency, but the latter, as also those for abortion, are, for reasons

[1] *Annual Report of Medical Officer of Health, Glasgow*, 1930.

referred to later, not strictly comparable with those for England and Wales. The maternal mortality rates recorded for Scotland and Glasgow have tended to rise continuously, though less steeply than the above table shows, since the beginning of the century. This dissimilarity in the statistics as between the two countries, with regard both to the relative magnitude and to the behaviour of the mortality rates, is shown in greater detail in the table in the Appendix, which gives the mortality rates since 1856-60 in quinquennial periods. It appears from a study of these maternal death-rates that the general trend of mortality, when Scotland is compared with England and Wales, has been in opposite directions. In both countries the rates up till the beginning of last century ran fairly parallel courses, with certain oscillations,

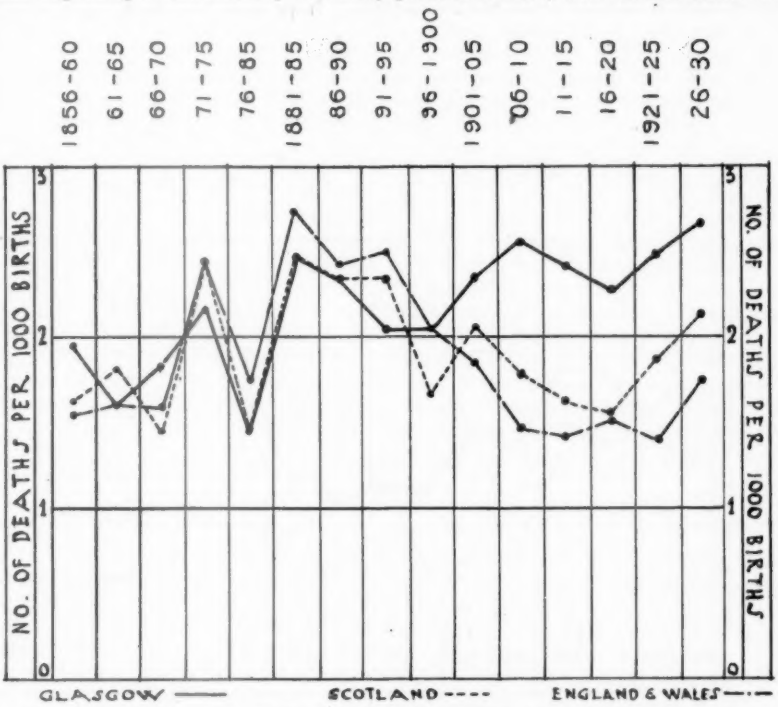

FIG. 1.—Puerperal sepsis. Deaths per 1,000 births in England and Wales, Scotland and Glasgow in quinquennial periods since 1856.

such as the rise in 1871-75, the fall in the next quinquennium 1876-80, and the subsequent peak in 1881-85. But since the end of last century a gradual divergence has taken place, the rate for Scotland and Glasgow progressively increasing, that for England and Wales steadily diminishing over a period of twenty years, followed by a slow subsequent rise in more recent years. (See charts, figs. 1 and 2.)

Fair comparison between the maternal death-rates of various countries, or at various times, can only be made if the method of expressing the death-rate is the same in each case. Accuracy also depends on correct certification of the specific nature of the cause of death—not always an easy matter—and of the fact that it is related to childbirth. It is probable that differing practice in classification may account for some, at least, of the differences in the recorded rates as between England

and Scotland. While in both countries care is taken to verify the facts where doubt arises as to the cause of death in relation to the puerperal state, it has been customary for the Registrar-General in Scotland to accord a high preference to childbirth in classifying the causes of death. To what extent lack of uniformity in classification accounts for the past decided differences in the statistics of the two countries, it is, of course, impossible to say. However, as there appears to have been no alteration in practice in this respect for many years, it would appear, therefore, that change of classification is not the reason for the difference in the secular trend of mortality in the two countries. The behaviour of these rates is an obscure problem. The rising mortality in Scotland is difficult to explain. What is the effect of the falling birth-rate (which is common to both countries), improving certification, changes in

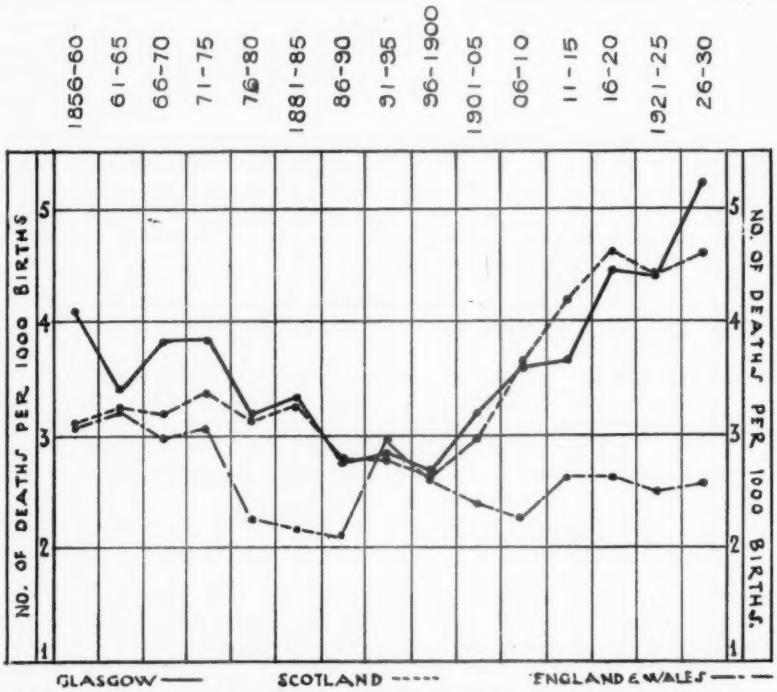

FIG. 2.—Maternal deaths other than those from puerperal sepsis. Deaths per 1,000 births in England and Wales, Scotland and Glasgow, in quinquennial periods since 1856.

obstetric practice, the curious pockets of high mortality in certain local areas—and so on?

It will be observed from the table given in the Appendix, and from the charts prepared, that puerperal sepsis has had a share in the increasing mortality. To what extent this is indicative of a real increase is again difficult to say. There is no doubt, however, that in recent years death certification has become much more accurate. There is reason to believe that this has been the case in Glasgow, and that fuller disclosure of the incidence and fatality of puerperal sepsis has been a far from negligible factor in the statistical returns. It may be mentioned here that a system of ascertaining certain facts about all deaths in the city was begun many years ago

by Dr. A. K. Chalmers. The association of a death with childbirth was often picked up in this way, and the facts, after inquiry, communicated to the Registrar-General.

Another important factor is the part played by septic abortion or miscarriage. For instance, among the cases admitted to the puerperal fever wards, as many as 24% were due to this cause. The deaths attributed to abortion in the returns of the Registrars-General were accordingly extracted, and are included in the Appendix table. The figures for Scotland and Glasgow, taken as they stand, 0·40 and 0·65 per 1,000 births during the last quinquennium, are higher than formerly, especially that for Glasgow. We are, however, met with this difficulty—that the English and Scottish data are not comparable, because of the differing methods of classification in vogue. In Scotland, deaths from post-abortive sepsis were assigned to abortion, but in England they were classified along with puerperal sepsis. I am informed by Dr. McKinlay, of the Department of Health for Scotland, that from 1931 these deaths from abortion will be split into two groups, post-abortive sepsis and abortion not returned as septic. His view is that the Scottish abortion figure, comparable with that for England, would be about one-quarter of the recorded rate, the remaining three-quarters being added to puerperal sepsis. It follows from the differing practice in classifying deaths, as between England and Scotland, that, on a comparable basis, the mortality rate from puerperal sepsis is to this extent greater than that actually recorded. As regards abortion, the most that can be said is that such figures as are available do not suggest that a significant increase has taken place, although in Glasgow the number of deaths (78) following abortion (which includes post-abortive sepsis) for the period 1926-30 is greater than in any similar previous period. This apparent increase is probably due to the practice of sending such cases to hospital, and to the efforts made to obtain accurate information as regards deaths following abortion. The Departmental Committee on Maternal Mortality and Morbidity remark that all statistical returns as to abortion must be accepted with great reserve. From now onwards, more accurate information will be available, but it is important that data bearing on this prominent cause of maternal death should be made as complete as possible by local inquiries and collaboration with the central department.

Administrative Measures in Relation to Incidence and Mortality.

Notification.—Notification of puerperal fever throughout the country came into operation in 1889, and was followed in Glasgow by provision of hospital treatment a few years later. Subsequent legislation in Scotland, such as the Notification of Births Act, 1907, the Notification of Births (Extension) Act, 1915, and the Midwives (Scotland) Act, 1915, which introduced an increasingly strict supervision of the practice of midwives, assisted in bringing puerperal sepsis more within reach of local administration. More recently—on October 1, 1929—the Puerperal Fever and Puerperal Pyrexia Regulations came into force. These successive enactments have, for one thing, caused an increasing flow of patients to hospital, necessitating two extensions of the accommodation. Thus, within the past few years, knowledge of the incidence of infection and of the part which sepsis plays in causing a fatal issue has become much fuller and more accurate. This movement has been aided by several factors: (*a*) the increased publicity accorded to this infection in Departmental Committee and other reports, and in the medical and lay press; (*b*) the influence of the current inquiry, commenced about three years ago, into the causes of maternal mortality, under the ægis of the Department of Health for Scotland; and (*c*) the alteration in the death certificate so as to secure information as regards association of death with childbirth, which came into operation in July, 1929 (applicable to married women only). Local administration is thus much better informed of the nature of its problems, and is more able to assess the value of its services. The two

principal influences have been: (*a*) provision of ample hospital facilities for treatment, and (*b*) notification of pyrexia.

Hospital facilities.—It has been the policy in Glasgow for many years that hospital accommodation should be available for all who require it. The changing outlook towards hospital treatment is illustrated by the increasing use now being made of this provision. The following table shows the extent to which this special service has expanded, and the greatly increased freedom with which authentic or suspected cases are now sent to the puerperal fever wards:—

TABLE III.—PUERPERAL FEVER. ADMISSIONS TO PUERPERAL WARDS AND CASE MORTALITY.

Year ended 31st May	Cases treated	Deaths	Case mortality per cent.	Year ended 31st May,	Cases treated	Deaths	Case mortality per cent.
,, 1913	119	36	30	,, 1923	246	56	23
,, 1914	128	32	25	,, 1924	205	43	21
,, 1915	156	57	37	31st Dec.,			
,, 1916	153	46	30	,, 1924	196	44	22
,, 1917	138	43	31	,, 1925	247	42	17
,, 1918	144	38	26	,, 1926	262	46	18
,, 1919	101	27	27	,, 1927	220	40	18
,, 1920	246	66	27	,, 1928	290	59	20
,, 1921	268	54	20	,, 1929	339	63	19
,, 1922	232	53	23	,, 1930	389	57	14
				,, 1931	405	52	13

Hospital beds for puerperal fever have been available since 1896, but in these earlier years fewer patients were sent to hospital, and at least half of them died. It will be observed that, especially in recent years, an increasing number of milder infections are being treated in hospital, as shown by the diminishing case mortality rate, which now stands at the low figure of 13%. On the other hand, the number of fatal cases has been little affected. As an example of the position which hospital treatment occupies, it may be pointed out that 93% of notified puerperal fever patients are either admitted to the special wards of the isolation hospitals, or occur and are treated in maternity hospitals. For instance, during 1931 there occurred in the city 71 deaths from puerperal sepsis (including 19 from post-abortive sepsis), as locally ascertained. Of these, 52 took place in the isolation hospital wards, and the remainder, with only two exceptions, occurred in other institutions where the patients had been confined. In spite of the ample provision of hospital beds for the treatment of puerperal infection and the full use made of them, it would appear that this measure has hitherto been of little avail in reducing the volume of fatalities and in lessening the maternal death-rate from this cause. This deduction is not altogether consistent with clinical considerations and with the excellent results of modern methods of treatment in many severe infections. It is impossible to believe that hospital treatment is other than salutary, and an explanation must be found elsewhere for the relative failure of hospital treatment as a factor in reducing the death-rate. The fact is, as will be explained later, that the hospitals are continuing to deal with an unabated number of extremely severe and fatal infections with which they are unable to deal satisfactorily.

EFFECT OF THE PUERPERAL FEVER AND PYREXIA REGULATIONS.

The object of these regulations is to secure notification of the morbid conditions of the puerperium accompanied by fever, and to enable puerperal infection to be recognized, investigated and treated at the commencement of the illness. Their enforcement has led to an increase in the notifications of puerperal fever as such. Further, it is common to find that a notification of puerperal pyrexia means, in fact, one of puerperal sepsis. The administrative arrangements made in connection with these regulations involve a scrutiny of all notified cases, verification of the diagnosis, followed by allocation, as far as possible, to the several puerperal conditions giving

rise to the fever. When this is done, the problem of incidence widens out considerably, as the number of known cases occurring annually has doubled within the past five years. The following table illustrates the movements which are taking place:—

TABLE IV.—GLASGOW. DATA REGARDING PUERPERAL FEVER AND PYREXIA.

Year	Puerperal fever	No. of deaths (M.O.H. figures)	Deaths as classified by Registrar-General	Cases per 1,000 births	Deaths per 1,000 births (M.O.H. figures)	Puerperal pyrexia	Deaths due to abortion sepsis included in M.O.H. figures	Cases treated in puerperal fever wards. (Deaths in brackets)
1921	321	72	—	10·8	2·4	—	—	268 (54)
1922	294	94	—	10·4	3·3	—	—	232 (53)
1923	278	72	—	10·4	2·7	—	—	246 (56)
1924	239	61	—	9·5	2·4	—	—	205 (43)
1925	300	68	—	11·8	2·3	—	—	247 (42)
1926	307	69	52	12·6	2·8	—	—	262 (46)
1927	277	61	47	11·7	2·6	—	14	220 (40)
1928	413	89	79	17·5	3·8	—	13	290 (59)
1929	†516	86	72	22·6	3·8	*49	13	339 (63)
1930	†598	86	65	25·6	3·7	235	19	389 (57)
1931	†663	71	66	27·2	3·1	228	19	405 (52)

* October to December.
† Corrected figures after transfer to this column of cases notified as puerperal pyrexia.

In compiling this table, an effort has been made by Dr. Walker to introduce as much accuracy as possible into a difficult subject. For instance, in 1931, 465 cases of pyrexia were notified, but on further scrutiny of the progress of the cases, 251 were regarded as due to puerperal infection, a change in diagnosis which took place mostly in hospital. It is apparent from the table that the effect of the new regulations has been to assist considerably the ascertainment of the amount of puerperal infection which, at the moment, has reached a proportion of 27·2 per 1,000 births. This figure is obtained by taking the total notifications for the year of fever and pyrexia together, which for 1931 was 891 cases, and endeavouring to assess the volume of actual puerperal infections. There is a tendency for the medical practitioner to adopt the alternative term, "pyrexia," as a designation in complying with his statutory duty as regards notification rather than to employ the older term "puerperal fever," as shown by the fact that over 50% of cases notified as pyrexia subsequently turned out to be definite cases of puerperal sepsis. The term puerperal pyrexia, therefore, is not only a widely embracing clinical sign accompanying many diseases causing a febrile state, but, in practice, connotes puerperal sepsis in approximately half the cases so reported. It is not assumed that these notifications reflect the full incidence of pyrexia as defined in the regulations, an ideal scarcely attainable. Probably the great majority of the cases other than transient mild infections are reported, especially when specialist advice, observation or treatment in hospital is desired. Ascertainment is also assisted by co-operation with maternity hospitals and homes, as well as by the operation of the rules regarding the duties of midwives in the matter of pyrexia. There remains a considerable residue of pyrexias, other than those regarded as due to sepsis, left over as a sort of side issue. Most of these occurred in maternity hospitals, while a number were admitted to the puerperal wards for diagnosis and treatment. Indeed, 70% of the pyrexias belonged to these two categories. An attempt has been made by Dr. Walker to classify them, as far as possible, on the basis of diseases of systems.

CLASSIFICATION OF PYREXIAS.

Administration is charged with the duty of distinguishing pyrexias due to puerperal infection from those due to other causes—a rather uncertain and difficult function. Since the regulations came into force this separation has been attempted, as explained above. Taking last year as an example, after transferring to puerperal fever such of the 465 notifications as seemed properly to belong to that category

there remained 228 cases of pyrexia accompanying a great variety of clinical conditions, as follows:—

Respiratory.—Pneumonia 33 (18 deaths), bronchitis 14 (2 deaths), phthisis 13 (10 deaths), pleurisy 4, influenza 11. *Circulatory.*—Heart disease 3 (2 deaths), phlebitis 7. *Blood.*—Secondary anæmia 3, pernicious anæmia 1. *Urinary.*—Nephritis and uræmia 4 (3 deaths), pyelitis 25, albuminuria 1, cystitis 2. *Digestive.*—Gastritis, enteritis, tonsillitis, etc., 9. *Metabolism.*—Eclampsia 1, serum disease 6. *Joints and Muscles.*—Rheumatism 2. *Lactation.*—Mastitis 32, engorged breasts 4. *Infections.*—Scarlet fever, erysipelas, mumps, measles, etc., 8. *Mental.*—Mania 2. *Accidents of Pregnancy.*—Incomplete abortion, etc., 16. *Accidents of Parturition.*—Perineal lacerations 2, Cæsarean Section 4, acute ovaritis 1, acute anteflexion 1. *Pyrexias of undefined origin* 19. This includes cases which could be ascribed to no other cause, and were probably puerperal infections. In addition, there were 42 other notifications, comprising 30 abortions and 12 due to a variety of other conditions not connected with childbirth.

It might be urged that the use of the term pyrexia as a basis for notification is purposeless and illogical when the cause is clearly due to some other condition than puerperal sepsis. If all such cases as defined in the regulations were faithfully reported, the number might be embarrassing, and it may be asked whether the use of a clinical term could not now be discarded, especially as facilities exist for obtaining expert advice as to diagnosis and hospital treatment in suspected or early cases. The practical question, however, is, does notification of pyrexia have the intended effect of directing attention to the possibility of sepsis, thereby securing treatment as quickly as possible? It has been pointed out, as one of the results of experience, that in one-half of the cases notified, pyrexia means sepsis, and in the other half is due to some other condition, thus throwing the onus of final diagnosis on those who receive the notification and administer the case. In actual practice, such a notification often means that there is a strong suspicion, or even a certainty, that puerperal sepsis is present. In fact, pyrexia is employed as a convenient synonym for the dreaded puerperal or child-bed fever. It is sometimes put to a psychological purpose as a novel and useful term, in order to make easier the path to hospital treatment of patients, when the home circumstances are not too satisfactory, or when it is felt that immediate admission is desirable. The notification of pyrexia, therefore, possesses advantages, and it would be premature to discontinue it.

Administrative Measures in Relation to Type of Case and Severity of Infection.

Reference has been made to the intractable nature of the mortality rate from puerperal sepsis. It will, therefore, be necessary to examine the results of hospital treatment in relation to the clinical and epidemiological features of the disease. To what extent are patients sent to hospital too late for treatment to be of any avail? Is there a high proportion of very severe and fatal infections? If so, under what circumstances do they occur? In what way can administration affect their incidence? Attempts to find answers to these questions have been made, and some material is available based on the inquiries, already mentioned, into (1) 800 hospital cases treated during two and a half years (1928 to 1930), by Dr. Margaret Thomas, and (2) 200 consecutive deaths from sepsis, by Dr. John Walker, covering a period of two and a half years up to February, 1932, during which every death was carefully investigated in connection with the arrangements made for collecting information relative to all maternal deaths, on receipt of the special returns from the local registrars. The results of these investigations, in so far as they cover the same ground, will be considered together.

The types of puerperal sepsis now occurring.—Post-abortive sepsis being common and peculiarly severe, the classification according to stage of pregnancy in both series studied is given in the following table:—

TABLE V.

Duration of pregnancy	Dr. Thomas's series: 800 hospital patients — No. of cases	Per cent.	122 hospital patients — No. of deaths	Per cent.	Dr. Walker's series: 200 consecutive deaths — No. of deaths	Per cent.
Full-time birth	573	71·6	94	77·0	144	72·0
Premature ,,	34	4·3	4	3·4	12	6·0
*Miscarriage	53	6·6	14	11·4	44	22·0
Abortion (– 3 months)	140	17·5	10	8·2		
Totals	800	100·0	122	100·0	200	100·0

* Up to 28th week of pregnancy.

As regards the hospital series, it is evident that one-quarter of the cases and one-fifth of the deaths resulted from sepsis following miscarriage or abortion, the deaths being higher in the former group, no doubt related to the fact that secret abortion is practised in the later stages. In 200 consecutive deaths from puerperal infection occurring in the city, termination of pregnancy before the 28th week was the forerunner in 22% comparable with the foregoing series. The prevalence of abortion in the community is unknown, but its results are obvious. As this form of maternal sepsis is responsible for a considerable proportion of the fatalities, and is, if anything, tending to increase (Table IV), it may be concluded that it is helping to maintain the high level of mortality from puerperal sepsis. The Committee on Puerperal Mortality and Morbidity, analysing 2,000 deaths in England, found 616 due to puerperal sepsis. They state that of 168 deaths from abortion, 146 followed sepsis. Thus, post-abortive sepsis accounted for 24% of the total deaths from puerperal infection. They do not, however, stress this figure as a correct reflex of what is occurring. While this difficult problem is closely linked to illegitimacy and concealment, it was found that 29 out of the 44 deaths in Dr. Walker's series occurred in multiparous women, several of whom had large families. In 31 there was a strong suspicion that abortion had been self-induced. A report recently issued by the Health Section of the League of Nations' Secretariat and based on a broad review stated that the maternal death-rate is even more affected by abortion than by delivery at term, and that in most countries, while the maternal mortality had been reduced, the post-abortive deaths remained at a high figure. It is recognized that the management of abortion requires as much care as does labour at term—or even more. These cases are, therefore, freely admitted to the maternity hospital and to the maternity wards of the municipal hospitals. (The proportion of abortions to cases admitted to the Glasgow Royal Maternity Hospital in 1929 was 19·5%). Unfortunately, many septic abortions are extremely severe, or are sent to the isolation hospitals much too late.

Early or Late Treatment in Relation to Mortality.—Both investigations deal fully with this point. Of the 200 consecutive deaths, in 146, or 73%, the confinement took place at home; 54 or 27 per cent., were confined in a maternity hospital. There were admitted to the puerperal fever wards for treatment 146 of the total series, or 73%. To show the stage of illness at which admission took place, the following table has been prepared:—

TABLE VI.

DEATHS OCCURRING IN A, B, C AND D.

D. Isolation hospital—showing interval between date of sickening and removal

Place of onset of disease	Days: 1	2	3	4	5	6	7	Weeks: 2nd	3rd	Unknown	Total	Total
A. Patient's home	7	49	19	20	10	13	6	6	8	6	2	139	146
B. Maternity hospital	45	1	1	—	2	2	—	—	—	1	—	7	52
C. Maternity home	2	—	—	—	—	—	—	—	—	—	—	—	2
Totals	54	50	20	20	12	15	6	6	8	7	2	146	200
Percentages	—	34	14	14	—	—	—	—	—	—	—	—	—

This table shows that 62% of the patients were admitted to hospital within three days after the onset of illness; in 34% admission was extremely prompt and practically immediate. Further, 45 deaths took place in isolation wards of maternity hospitals, where the patients had been under hospital care from the beginning. Promptitude of admission to hospital could, no doubt, be improved upon, but it may be inferred from the data given that there still occurs a considerable volume of severe virulent infections of septicæmic type, against which modern methods of treatment are of little avail. Septicæmia is entered as the cause of death in 128 cases.

The hospital experience with regard to the stage and severity of illness on admission may next be considered. For the purposes of her investigations, Dr. Thomas divided her cases into the following four clinical groups: Group I. Infection limited to perineum, vagina, and cervix, and usually associated with laceration of these parts; frequently accompanied by slight—and occasionally by marked—subinvolution of the uterus. Group II. Infection established within the uterus, causing septic or putrid endometritis; in many cases associated with lacerations, and sepsis of the lower parts of the genital tract, and with retained placental debris. Group III. Infection spreading to the adnexa, pelvic cellular tissue and peritoneum, and accompanied by gross, or by only minimal, involvement of the uterus itself. Group IV. Infection invading the blood-stream, as in septicæmia and pyæmia; this may be concurrent with slight or severe local sepsis, and with an active spreading lesion, but the blood infection is the dominant feature." With the help of this clinical classification, it is possible to ascertain the kind of case with which treatment is concerned, and, roughly speaking, the relative frequency of the milder and severer types of disease produced by septic infection. This is given below as regards 800 hospital admissions.

TABLE VII.—ANALYSIS IN RELATION TO CLINICAL GROUPS.

	Admitted to hospital				Fatal cases			
	Full-time and premature birth	Miscarriage and abortion	Total	Percentage of total	Full-time and premature birth	Miscarriage and abortion	Total	Percentage of total
Group I ...	76	36	112	14·0	—	—	—	—
Group II ...	249	99	348	43·5	2	4	6	4·9
Group III ...	187	41	228	28·5	20	5	25	20·4
Group IV ...	95	17	112	14·0	76	15	91	74·7
Totals	607	193	800	100·0	98	24	122	100·0

The mild cases in Group I (14% of the total) recovered readily, and it is probable that many of this class do not reach hospital. The intermediate Groups II and III are in the great majority, forming together 72% of all the admissions. Group IV, composed of the most severe cases, admitted with established blood-infection, amounts to 14%, contains 112 cases, and yields 91 deaths. With reference to these, Dr. Thomas says, "The importance of systemic infection in determining a fatal issue is thus evident, and the extreme fatality of post-abortive septicæmia is also to be observed. In a fifth of the fatal infections death resulted from spreading pelvic inflammation frequently associated with peritonitis, but occasionally of a less virulent type, characterized by phlebitis and pyæmic manifestations." Administrative interest centres chiefly round Groups III and IV, which provide the fatalities. It was found that the admission of these patients to hospital did not tend to be unduly delayed, as compared with the remainder, as 59% reached hospital on or before the third day, and over 70% on or before the fourth day of illness. In this series of hospital patients as a whole, the average duration of illness prior to hospitalization

was 4·4 days, or, omitting the abortions and miscarriages, 4·1 days; 50% were admitted on or before the third day, but 11% not until the third week.

The impression gained from these figures is that, on the whole, early notification and hospitalization were practised, but this is not entirely in accord with clinical experience that it was often very evident that there had been undue delay, and that the prognosis was thereby adversely affected. As compared with former years, however, the improvement is very noticeable, while there is room for still greater promptitude. Dr. Leonard Colebrook points out the importance of making an early bacteriological diagnosis on the first sharp rise of temperature to about 101° F., when infection by the hæmolytic streptococcus would be detected within twenty-four hours—an extremely high standard to reach. It may be concluded that the policy of hospital treatment is having a fair trial, but is handicapped by the prevalence of an extremely virulent and rapidly fatal form of infection, in which post-abortive sepsis takes a prominent and even increasing share.

The more grave the disease, the more likely is it to be associated with the streptococcus. In her series of 800 cases, Dr. Thomas isolated a streptococcus in 54%, a proportion usually found in puerperal sepsis. In the severe cases of Group IV above, it was present in 79%, and in the same proportion in those who died. Among 174 patients who were seriously ill on admission, 97 gave a positive blood-culture, of which 85% were streptococcal in character.

The incidence of the hæmolytic streptococcus in this series is not known, as differentiation into types was not made. During 1931 Dr. Foulis examined 260 patients admitted to the puerperal fever pavilion at Robroyston Hospital, Glasgow, from whom he recovered a hæmolytic organism in 50%. In the severe cases where blood infection was present, the prevailing organism was the hæmolytic streptococcus, which accounted for 70% of the cases where blood-culture was positive.

I do not know whether the clinical groups previously quoted prevail elsewhere in similar proportions, or whether streptococcal infections of a severe kind are more common in Glasgow. This would almost appear to be the case, and suggests the interesting speculation whether the puerperal streptococcal infections tend to be more severe in northerly parts of the country, an attribute which the pneumococcus seems to possess. At any rate, the tables of the Registrar-General indicate that the mortality from puerperal sepsis is appreciably higher in the north of England than it is in the south. The investigations of Dr. Colebrook, to whom much of this knowledge is due, suggest that the possibility of controlling puerperal sepsis is largely bound up with further researches into the natural history of this organism, its epidemiology, its mode of attack, and its immunology. If it should be found that the carrier plays an important rôle in the spread of this infection, a formidable administrative difficulty will arise. From an epidemiological point of view, there is no definite evidence on which to postulate a carrier. It is extremely rarely that doctors or midwives leave a suggestive trail of infection. The tenement system of housing in Glasgow might be regarded as favouring the incidence and severity of puerperal sepsis by increasing the danger of carrier infections in congested and overcrowded areas, but there is no definite evidence of such an association. The incidence of puerperal sepsis occurs fairly uniformly throughout the city, the better class wards being affected equally with the poorer ones. The difference in incidence is small, as shown by an inquiry of Dr. Chalmers,[1] covering the period 1918-22, from which he concluded that the facts "would appear to suggest that insanitary conditions of themselves have little influence on the incidence of the disease." In the detailed analysis of 200 consecutive deaths from sepsis, it was found that overcrowding was not present as a social factor to any greater extent than occurs in the houses of the city generally.

Questions of treatment are outwith the scope of this paper, but it is proper to

[1] *Annual Report of Medical Officer of Health, Glasgow*, 1924.

make a very general reference to the position which therapeutic measures were found to occupy in the series of 800 patients admitted to hospital. Dr. Thomas, in her report, gives a full description of the results of various local and general methods of treatment, such as by glycerine, arsenical and mercurial preparations, vitamins and serum—the serum being the same as that used in the treatment of scarlet fever. This serum was administered to 395 patients, including 37 (treated intravenously) out of 83 patients in Group IV, i.e., the very severe septicæmic cases. Generally speaking, there was clinical evidence that some very toxic patients received immediate and lasting benefit, a few showed slight improvement, but there was a large group whose general condition was not influenced. The employment of this serum appears to be justified because of its antitoxic effect in certain cases, and on the assumption that, although it has no anti-bacterial value, it may enable the patient the better to deal with the bacterial invasion of the tissues. Serum has also come into use for prophylactic purposes, and Dr. Samuel J. Cameron, working along with Dr. Thomson at the County of Lanark Maternity Hospital, Bellshill, has obtained suggestive results by administering a puerperal streptococcus antitoxin as a routine in all complicated cases, and in all normal cases in which the perineum had been lacerated.[1] In two years' experience (1929 and 1930) of this practice, the general pyrexia rate in the hospital was reduced to 2·8%, and to 0·3% for normal cases, taking the results for 1930 as compared with 1925, when the general pyrexia rate was 7·5% and 3·8% for the normal cases. Further trial is being made in the Glasgow hospitals by Dr. Adam Barr and others. A very valuable step in prevention would be taken if the resistance of the patient could be raised to the prevailing organism.

Circumstances associated with infection.—The general results of administration which have been outlined furnish a measure of the present limitations of notification and treatment as factors in the mortality from puerperal sepsis. The general problem of prevention is now held to depend largely upon measures of a quite different order, directed to reducing the opportunities for infection. The Committee on Puerperal Mortality and Morbidity studied this aspect of the question very minutely, and their recommendations in the direction of an improved midwifery service are well known. In the local investigation of 200 consecutive deaths from puerperal sepsis, very similar points arise. It was found to be extremely difficult to assess the attendant circumstances when the patient was presumed to have become infected. The inquiry however, corroborates what has been often pointed out, that labours in cases in which some form of interference has taken place are more liable to end in sepsis. In 90 out of the 200 patients who died there was some departure from the normal. These dfficult labours were as follows: Forceps 48, induction 3, version 4, hysterotomy 2, breech 7, twins 8, retained placenta 6, hydrocephalus 1, inertia 2, occipito-posterior 4, Cæsarean section 4, incision of cervix 1, total 90. Thus, out of 200 fatal cases, 45% required some form of manipulation, including 24% forceps deliveries, of which six belonged to the category of "failed forceps." This appears to be a high forceps rate, though comparative data as to the rate prevailing in general obstetric practice are not available. In Dr. Thomas's series of 800 hospital cases treated for sepsis, forceps had been applied in 25%. The other abnormalities no doubt occur with some frequency in obstetric practice, about which there is no equivalent information on which to base statistical comparisons. It may be noted that in 55% of these fatalities the course of labour was normal, and it is well recognized that a very severe infection may develop under conditions where there is no apparent predisposing cause. In 93 of the cases there had occurred injuries at birth, 41 being slight tears, the remainder more severe and occurring chiefly in association with difficult labour.

Nothing is to be gained by giving further statistical data collected from a small series of instances and without controls. It is perhaps sufficient to say that the

[1] Paper read to the Obstetrical Society of Edinburgh, Feb., 1932.

detailed consideration given to the circumstances of each case by an experienced obstetrician to whom they were submitted led him to the conclusion that in a very considerable number of the cases there had been errors of judgment or departures—sometimes serious departures—from correct obstetric practice in the conduct of the labour or of the puerperium. This is in keeping with the general conclusions reached as the result of many inquiries into the problem of maternal mortality and morbidity throughout the country. It is considered by those competent to judge that much septic infection would be prevented by a general improvement in the maternity and ante-natal services, and better facilities for the safe conduct of labour.

Summary.

I have endeavoured to outline the general effect of successive administrative measures and of the forces which have been converging on the problem of puerperal infection in a large urban community. (1) As regards the vital statistics, some of the recorded increase in the mortality rate may be more apparent than real, owing to increasingly accurate diagnosis and certification of the puerperal causes of death. Every effort has been made locally to assist correct ascertainment in collaboration with the department of the Registrar-General. Incidentally, comparative statistical studies as between Scotland and England are rendered difficult and unsatisfactory because of differing methods formerly adopted in classifying deaths. (2) The mortality rate for Glasgow due to puerperal sepsis, ascertained as correctly as possible, was 3·1 per 1,000 births during 1931, a figure which includes deaths from post-abortive sepsis. (3) The effect of notification of puerperal pyrexia has been to double the volume of known cases of puerperal sepsis occurring annually. Pyrexia means, in fact, sepsis in half the cases so notified. (4) The volume of cases admitted to hospital for treatment has also almost doubled. Home treatment is not undertaken, and 93% of all puerperal sepsis is treated in hospital. (5) The epidemiological picture has become much clearer as fewer cases and fewer deaths escape detection. (6) Although the case mortality in hospital was as low as 13%, and 60% were admitted on or before the third day of illness, the number of fatal cases has not diminished. (7) In explanation of this, there are two outstanding facts: (*a*) Deaths due to sepsis following abortion (one fifth of the total) are tending, if anything, to increase. This is, in the nature of things, an extremely difficult problem. (*b*) There is continuing to occur, with apparently undiminished frequency, a very severe and fatal type of infection, which epidemiological studies have so far failed to explain. (8) The majority (at least 70%) of these grave septicæmic cases are due to infection by a hæmolytic streptococcus, concerning the prevention or treatment of which little is known. Why should it be relatively more common and fatal in Glasgow? (9) It would appear that the possibility of controlling puerperal infection depends largely on the scientific investigation of this organism, and on further combined clinical and bacteriological researches directed to the avoidance of infection in obstetric practice and to the prevention of the consequences of infection. As obstetric difficulties seem to play an important predisposing part, they should be anticipated as far as possible by ante-natal skill and care. The reduction of puerperal infection to a minimum will constitute a severe standard by which to judge the success of an improved midwifery service.

The paper was discussed by Dr. Remington Hobbs, Sir Weldon Dalrymple-Champneys, Dr. Jane Turnbull, Dr. Clark Trotter, Dr. R. M. Fry, Dr. D. Sage Sutherland, Dr. S. Monckton Copeman, and the President. Dr. Macgregor replied.

Appendix.—A Table of Maternal Deaths.

Quinquennial Periods from 1856 *to* 1930. *England and Wales, Scotland and Glasgow compared.*

	England and Wales				Scotland				Glasgow			
	Puerperal sepsis	Abortion	Other maternal causes	Total	Puerperal sepsis	Abortion	Other maternal causes	Total	Puerperal sepsis	Abortion	Other maternal causes	Total
	No. of Deaths.											
1856-1860	5,196		10,279	15,475	851		1,618	2,469	154		322	476
1861-1865	5,798		11,701	17,499	995		1,785	2,780	138		292	430
1866-1870	6,132		11,623	17,755	839		1,822	2,661	170		358	528
1871-1875	10,217		12,628	22,845	1,462		2,037	3,499	217		383	600
1876-1880	7,728	606	9,383	17,717	927		1,961	2,888	146		326	472
1881-1885	12,355	620	9,080	22,055	1,575		2,068	3,643	244		333	577
1886-1890	10,722	548	8,767	29,037	1,455	200	1,529	3,184	230	27	242	499
1891-1895	11,368	984	12,573	24,925	1,483	164	1,582	3,229	228	43	272	543
1896-1900	9,445	990	11,231	21,666	1,091	135	1,587	2,813	246	32	292	570
1901-1905	8,685	744	10,599	20,028	1,367	141	1,843	3,351	291	33	362	686
1906-1910	6,807	491	9,910	17,208	1,155	168	2,165	3,488	303	38	385	726
1911-1915	6,152	579	10,722	17,453	976	223	2,327	3,526	313	53	418	784
1916-1920	5,688	563	9,267	15,518	855	296	2,238	3,389	303	65	531	899
1921-1925	5,363	500	9,069	14,932	1,051	229	2,247	3,527	337	58	541	936
1926-1930	5,719	377	8,015	14,111	1,033	193	2,023	3,249	315	76	541	932
	No. of Deaths per 1,000 *Births.*											
1856-1860	1·551		3·068	4·619	1·632		3·103	4·735	1·958		4·094	6·052
1861-1865	1·600		3·228	4·828	1·813		3·252	5·065	1·618		3·424	5·042
1866-1870	1·582		2·999	4·581	1·467		3·185	4·652	1·826		3·846	5·672
1871-1875	2·457		3·037	5·494	2·429		3·384	5·813	2·184		3·854	6·038
1876-1880	1·744	0·137	2·118	3·999	1·470		3·111	4·581	1·440		3·215	4·655
1881-1885	2·767	0·139	2·034	4·940	2·492		3·272	5·764	2·460		3·358	5·818
1886-1890	2·423	0·124	1·980	4·527	2·347	0 323	2·466	5·136	2·364	0·278	2·487	5·129
1891-1895	2·504	0·217	2·770	5·491	2·358	0·261	2·515	5·134	2·042	0·385	2·437	4·864
1896-1900	2·046	0·214	2·434	4·694	1·676	0·207	2·438	4·321	2·037	0·265	2·418	4·720
1901-1905	1·851	0·158	2·258	4·267	2·065	0·213	2·784	5·062	2·364	0·268	2·940	5·572
1906-1910	1·478	0·107	2·152	3·737	1·791	0·260	3·357	5·408	2·572	0·323	3·268	6·162
1911-1915	1·421	0·134	2·476	4·031	1·618	0·370	3·857	5·845	2·417	0·409	3·227	6·053
1916-1920	1·510	0·149	2·461	4·120	1·558	0·539	4·079	6·176	2·276	0·488	3·990	6·754
1921-1925	1·401	0·131	2·369	3·901	1·873	0·408	4·003	6·284	2·488	0·428	3·994	6·910
1926-1930	1·751	0·115	2·454	4·320	2·137	0·399	4·186	6·722	2·672	0·645	4·588	7·905

Section of Therapeutics and Pharmacology.

President—Dr. E. P. POULTON, F.R.C.P.

[*March* 8, 1932.]

DISCUSSION ON SPECIFIC AND NON-SPECIFIC DESENSITIZATION IN ALLERGIC DISEASES.

Dr. G. H. Oriel.[1]—This discussion is variously described as "The treatment of asthma," and "Specific and non-specific therapy in allergic disease."

Now asthma is not synonymous with allergy. Asthma is a *symptom* which may be due to several causes. We may at once dismiss cardiac asthma and renal asthma, and consider only asthma in the sense of a condition in which there is periodical difficulty in breathing, the difficulty being chiefly in expiration. There is complete freedom between attacks. The confusion of this condition with allergy has arisen because a certain proportion of cases of asthma can be shown to depend on allergy, that is, "an altered reaction to foreign protein." Successful treatment of asthma depends on the clear recognition of this distinction.

Specific and non-specific therapy in allergy.—There are three possible states: (1) Normal, in which antibodies to proteins do not occur. (2) Sensitization, in which antibodies to proteins do occur and are fixed in the tissues. (3) Immunity, in which antibodies to proteins occur and are also in the circulation. The object of specific therapy is to neutralize the antibodies which are fixed in the tissues, and change the condition back to normal, i.e., the condition in which there are no antibodies. Specific desensitization can only be successful with one protein at a time; that is to say, if a patient is sensitive to cat and dog, desensitization to cat, even if successful, leaves the sensitization to dog unaffected. Non-specific desensitization, on the other hand, seems to affect all sensitization. Various substances have been used for this purpose. In this country peptone, as recommended by Auld, has been extensively used. Professor Storm van Leeuwen has found that the best results are obtained by the use of tuberculin. He has also used injections of sulphur. Typhoid paratyphoid vaccine is another substance which has been used. I cannot speak from personal experience of these methods, but it has always puzzled me to understand their rationale. Undoubtedly beneficial results are obtained. Recently Rackemann has put forward a most ingenious suggestion. He points out that rabbits sensitized with egg protein, so that precipitins to egg occur in the rabbit's blood, after several months have no egg precipitins in the blood. When, however, these rabbits are injected with typhoid paratyphoid vaccine the blood is again found to contain precipitins to egg. Rackemann's suggestion is that the condition becomes one of sensitization during the interval, that is, that the antibodies become fixed in the tissues, and that the "protein shock" loosens the sessile antibodies and so changes the condition into immunity. He offers this as an explanation of the beneficial results obtained with non-specific therapy. Incidentally, this explanation would also account for the fact that the results of non-specific therapy are usually

1 Working at Guy's Hospital with the aid of a grant from the Medical Research Council.

not permanent. The antibodies become fixed again in the tissues. They can be driven out again by further protein shock, but it cannot be called a true desensitization.

The necessity for care in distinguishing allergic asthma from other forms of asthma is therefore plain, for specific treatment obviously cannot be applied with success in a non-allergic case. There are no specific antibodies to neutralize if the case is non-allergic. Similarly non-specific protein therapy would not be expected to alter the condition. How can these two types be distinguished from each other?

(1) By skin tests to the different proteins.—These tests are, of course, well known, and can be dismissed shortly. If positive skin tests are obtained the condition probably depends on allergy. But it is necessary to make a large number

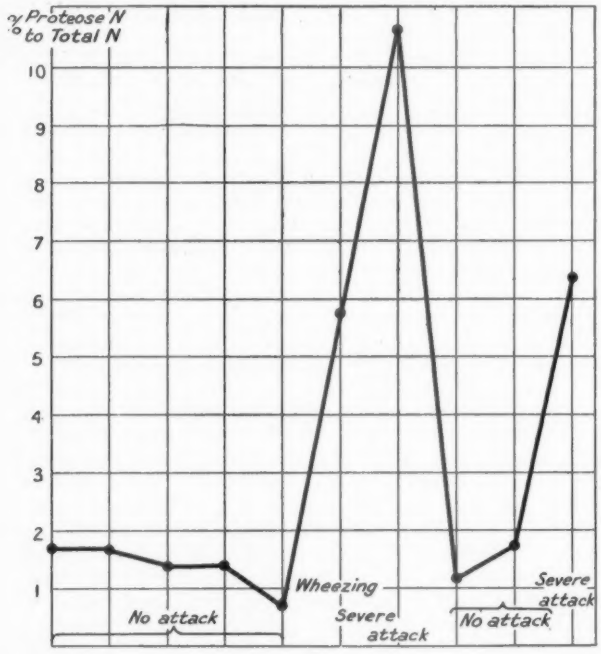

FIG. 1.

of tests which is fatiguing to all concerned. I once saw a patient who had 350 tests made on him, all negative! Methods of shortening this procedure have therefore been sought.

(2) Professor Storm van Leeuwen has shown that extracts of human dandruff give positive skin tests when injected intradermally into patients whose asthma depends on inhaled antigens. I will deal with that test more fully later on.

(3) There is a type of asthma which shows an increase in the amino acids in the blood during attacks. This type corresponds fairly closely to the one in which symptoms are caused by the ingestion of foods to which the patient is sensitive, or to the injection of serum, or cases of eczema, urticaria, etc., not depending on external irritants. It was whilst investigating this last type that Dr. Barber and I

found that the urine of such patient, if acidified and shaken with about a quarter of the volume of ether, on standing gave an ethereal emulsion which varied in density according to the acuteness of the attack from which the patient was suffering. It was subsequently found that if the urine were run off and the ethereal emulsion treated with an excess of alcohol, a precipitate was obtained which gave the usual reactions to tests for protein, biuret, Molisch's test, etc. There was, however, a considerable quantity of inorganic salts present, and it was found that these could be removed by suspending the precipitate in distilled water and recentrifuging. In this way an organic substance of a protein nature was obtained. Let us call this the P substance, because it resembles proteose. Dr. Barber and I have pointed out that if the nitrogen in the form of proteose was compared with the total nitrogen of urine, the relative proportion of proteose nitrogen was greater during an acute attack of allergy than in the interval. This was confirmed by Lyon, Percival and Stewart.[1] I have made a graph from their figures (see fig. 1). There is a marked rise in the percentage of proteose to total nitrogen shown by them during an attack of asthma. It was found that the P substance would give positive skin tests with the patient from whom it was obtained. Originally I thought that the skin tests were obtained with the patient from whom this substance was obtained and not with other asthmatics. At that time I was relying on the scratch tests. Further work showed that this statement required modification. Dr. Conybeare and I tested the patients at the Asthma Clinic at Guy's Hospital with the P substance from a case of asthma which was sensitive to pollen, cat, dog, feathers, etc.; 14% of pollen sensitive patients failed to give positive skin tests with P substance from a case of asthma who was pollen sensitive, whereas 76% of non-pollen sensitive cases failed to react with the same substances. On the other hand, with P substance from a non-pollen sensitive case of asthma, only 17% of pollen sensitive and 14% of non-pollen sensitive cases gave positive skin tests.

It would appear from this investigation that there is a distinction which can be drawn between cases of asthma, namely, that the P substance from a patient with multiple sensitizations gives positive skin tests with asthmatics who have been demonstrated to have similar sensitizations, and not with other asthmatics who do not. Also, that the P substance from this second type of asthmatic does not give positive skin tests with type I, the sensitized type.

This work has been disputed. Dr. John Freeman, for instance, was unable to obtain positive dermal reactions either with the P substance obtained from the urine of his patients, or with the P substance which was used in the foregoing experiments. Dr. Storm van Leeuwen kindly allowed me to test the patients in his clinic with this same P substance. When the tests had been made and we had agreed as to which results were positive and which were not, Professor Storm van Leeuwen pointed out that those patients who gave a positive reaction with the P substance also gave a positive reaction with his human dandruff test. This point was interesting. On my return Dr. Bruce Pearson made an extract of human hair, and I made two P substances, one from a case which gave positive skin reactions to pollen, cat, dog, etc., and one from a normal person. Dr. Pearson injected these three substances intradermally into the patients at the Asthma Clinic; his results will be given presently. In his investigation Dr. Pearson was comparing the effect of the P substance from a case of asthma with multiple sensitizations, with the effect of human hair extract, and P substance from a normal person. His results confirm those of Dr. Conybeare in that again two types of asthmatic were demonstrable, and also confirm Professor Storm van Leeuwen's observation that the P substance from an asthmatic with multiple sensitizations will give positive skin tests in cases which respond to human hair.

[1] *Brit. Med. Journ.*, 1932 (i), 136.

Application to treatment.—I shall take an illustrative case which was under the care of Dr. E. P. Poulton, who kindly allowed me to carry out the following experiments. This was a case of urticaria of unknown origin, but severe. I made the P substance during the attack, and put it up in strengths of 1/1,000, 1/10,000, 1/100,000, and 1/1 million. Positive dermal reactions were obtained in strengths of 1/10,000. Now, the most convincing part of this test was that within a few hours

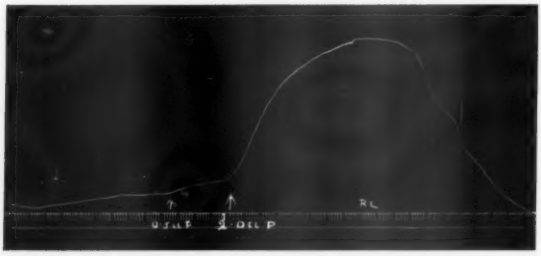

FIG. 2.—Tracing from one horn of the uterus of a guinea-pig suspended in Ringer solution. A solution of proteose from Dr. Poulton's case was made in Ringer solution. At the point marked 0·5 c.c. P this quantity of the proteose was added to the surrounding fluid and was found insufficient to cause a contraction. 2·0 c.c. P indicates a further addition of this solution, when a typical contraction occurred.

of its being made, the patient had an acute exacerbation of symptoms, with angio-neurotic œdema in addition. It is difficult to see, if the injection of such a minute quantity of substance will produce a typical attack, that this substance is not the cause of the condition. Having this meeting in mind, I tried to obtain further evidence.

FIG. 3.—After changing the Ringer solution this process was repeated with the proteose and no contraction resulted, showing that the uterus was desensitized. At the point marked "Hist." histamine was added and a marked contraction occurred, showing the uterus still responded to stimuli After changing the Ringer solution a further quantity of histamine solution was added and an *equal* response was obtained. This second addition of histamine was made to show the difference between the effect of P substance and histamine. In a sensitized uterus one application of the specific antigen causes a contraction. The second application does not. With histamine, on the other hand, the second contraction is equal to the first.

(1) Prausnitz-Küstner. I sensitized two areas in my arm, and injected into one Evans' solution and into the other a 1/10,000 solution of the patient's proteose. An unsensitized area was also injected as a control with the proteose solution. A positive reaction was obtained only where the proteose solution was injected into a sensitized area. Further, I injected a guinea-pig intraperitoneally with 5 c.c. of serum from this case. Next day the uterus was suspended in Ringer solution according to the Dale technique. Figures 2, 3, and 4 show the results.

There is a further point of interest in this case. The patient did not give positive skin reactions with hair extract or with the P substance which was used at the demonstration, nor did the asthmatic patients respond to her P substance. I might mention in passing that this patient has now ceased to show symptoms. She has been treated with small doses of the 1/1 million solution at four-day intervals.

To prove that a substance is specific and is the cause of allergic symptoms in an allergic patient, the following criteria are necessary:—

(1) (The most important.) Exposure to the antigen should reproduce the symptoms. (2) The Prausnitz-Küstner reaction should be positive. (3) Passive sensitization of guinea-pigs should be possible, although this is usually impossible to demonstrate in asthma, hence Coca's postulation of "Reagins." (4) Positive dermal reactions should be obtained. In the case quoted, all these four criteria were fulfilled.

FIG. 4.—As a further proof that it is not histamine in the P substance which is responsible for the positive skin tests and uterine contractions, fig. 4 shows the action of the same quantity of P substance which gave the contraction in fig. 2 tested on an *unsensitized* guinea-pig uterus. At Hist., histamine was again added.

It is difficult to know quite what conclusions to draw from these and similar investigations. The P substance seems to vary in character in the same case from time to time. We have frequently had to make several attempts to isolate an active product. A case of asthma with multiple sensitizations was taken into hospital, and I was quite unable to isolate a P substance which would give positive skin tests. On his return to his home surroundings, however, an active preparation was isolated. The reasonable explanation would appear to be that it is only when the patient is in contact with the antigen to which he is sensitized that an active preparation can be made. Another difficulty is that, using the same preparation on the same patient, different results were obtained at different times. A further difficulty is to find a hypothetical explanation of the facts. Is it possible for an allergic patient to become sensitized to his own breakdown products? In the instance of Dr. Poulton's case of urticaria, if the experiment I showed you was properly conducted, it would appear that antibodies to the P substance must have been circulating in the blood of the patient, otherwise the P substance would not give a contraction with a passively sensitized guinea-pig, whereas the substance had no effect on a normal guinea-pig.

Again, all asthmatics do not give positive tests with their own or other P substances. It was for this reason that I was so interested in Professor Storm van

Leeuwen's observation that this group also do not give positive reactions with human dandruff. We are accustomed to treat this non-sensitive group with vaccines, but it is quite possible that Dr. A. Hurst's suggestion is correct, and that they are really vagotonics. It seems quite certain that they have nothing to do with allergy.

Professor W. Storm van Leeuwen (Leiden).—The basis of this kind of treatment is the fact that during the course of acute infectious diseases asthma and other allergic symptoms usually disappear temporarily. The typical illness which is beneficial for asthma is lobar pneumonia. Even hopeless cases of asthma which are resistant to any form of therapy yield to the natural therapy of lobar pneumonia. I have till now heard of no exception to the rule. The beneficial effect of pneumonia may last only as long as the patient is ill, but often endures for many weeks or even months after recovery from the pneumonia. Other infectious diseases, for example, angina, scarlatina, erysipelas, mumps—may have a similar effect, but as a rule the influence is less marked and less lasting. Influenza, measles and whooping-cough, on the other hand, often make asthma worse, or may even give rise to the first symptoms of asthma in a patient previously unaffected.

The logical consequence of these facts would be an effort to induce lobar pneumonia in severe cases of asthma in the same way that Wagner v. Jauregg treats general paralysis with malaria. Artificial infection of asthmatics with lobar pneumonia is difficult, dangerous, and therefore not to be considered.

Repeated attacks of fever had in many cases a beneficial action of extraordinary intensity. Our experiments with this disease enabled us to divide our asthma cases into a group which might derive great benefit from the treatment, and a group which would certainly not be benefited. It may be added that in no case did the infection have an unfavourable influence on the course of the asthma.

The patients who derive no benefit of any considerable duration from fever treatment are those who are hypersensitive to certain allergens and who cannot avoid contact with these allergens after leaving the clinic. In those cases the attacks of asthma only disappear so long as the temperature is high, but the beneficial effect does not last longer than a few days.

Some patients, for example, who were pure cases of house allergen-asthma received treatment with repeated attacks of fever, in the clinic. Ten days after the end of the first attack of fever they were sent home and asthmatic attacks developed two days afterwards. Here, then, no beneficial result at all was reached, and it may be surmised that all similar cases will react in the same way. Hence, fever treatment will also be useless in cases of hay fever or of food allergen, or sensitiveness to epidermal products, if contact with the allergen cannot be avoided.

The treatment with repeated attacks of fever, however, often gave excellent results in those cases of asthma which, by lack of more definite knowledge of the ætiology, are grouped as the "bronchitic form." Those patients are not benefited by residence in the allergen-proof chamber, they are not hypersensitive to the known allergens, they give for the most part weak skin-reactions to bacterial vaccines, and they generally show asthmatic symptoms permanently.

A subgroup of this type of asthmatics is formed by patients characterized by hypersensitiveness to aspirin and similar drugs. This group, which contains 10% of my material, contains the severe asthma cases who, as a rule, present the greatest difficulties in treatment. We have found that this group reacts particularly well to treatment with fever. Many cases who could be influenced by no other form of treatment and who had been invalids for several years, kept free from asthma during more than half a year and were able to work again for a year or longer. As a rule attacks set in again later and sometimes the condition became as

bad as it had been before, so that a *cure* of the disease was seldom realized. Nevertheless, the suffering induced by the repeated attacks of fever was more than compensated for by the freedom from attacks during a considerable time.

These experiments with fever therapy apart from its having been of great temporary benefit to a number of patients, have widened our views on the question of non-specific treatment.

One of the most important questions relative to non-specific treatment is: Why is it that infection with these diseases gives temporary relief of asthma? Various hypotheses have been advanced in recent times. None of them, however, could, in our opinion, be proved to any degree of certainty. Two of these hypotheses, i.e., the hypothesis of the changes in acid-base equilibrium and the hypothesis of changes in white cell count have been tested by us.

During lobar pneumonia certain changes in the leucocyte formula occur, the most characteristic of which is a decrease, sometimes a disappearance, of eosinophils in the blood. We found that not only after pneumonia but also during other artificially induced periods of well-being in the asthmatic, there is a diminution in eosinophilia. We found the phenomenon during hunger, during sulphur treatment and it is also found in acute stages of artificially induced illnesses. But we also found that the beneficial effect of the illness or the therapeutic measure often lasted much longer than the decrease in eosinophilia, so that the two phenomena, although often running parallel, are not necessarily linked together or dependent upon a common cause.

As to changes in acid-base equilibrium of blood and urine, we found them much less frequent than would be expected from the study of published work. The general trend of opinion is that a shifting of the equilibrium to the acid side is beneficial for the asthmatics, and a shifting to the basic side bad. As a matter of fact, we sometimes found a tendency to acidity during artificially induced fever, but this seldom went so far that the pH of plasma changed to a noticeable degree. On the other hand, we often noticed an improvement in the patient without any change in acid-base equilibrium and we even succeeded in keeping the balance on the basic side (by dosage of alkalies) during a fever period, without impairing the beneficial result. And apart from all these considerations stands the fact that the influence of fever therapy on the allergic state may last for weeks and months after the return of acid-base conditions to normal values.

Our opinion then is that the explanations given thus far for the beneficial influence of fever therapy are of little value and that the mechanism of fever therapy remains unknown.

Tuberculin therapy.—When Varekamp and I introduced tuberculin therapy of asthma ten years ago we had based it on a train of ideas, expressed as follows. Most asthmatics belong to the group of hypersensitives, but only in a small percentage of cases can the causative agent of the attacks be found. Hence specific treatment is seldom possible. If, however, we could find some other substance to which these asthmatics are sensitive we could treat our patients with that substance, hoping that the reactions obtained might reduce the intensity of the other sensitivities. We know that most of our asthma patients reacted strongly to tuberculin with the von Pirquet test, and consequently we chose tuberculin to induce a "reaction." Seen in the light of our present knowledge of the influence of infectious diseases on asthma, our conception of ten years ago appears to be more correct than we then supposed. Artificially induced infection with the agent of an infectious disease would be, if it could be realized without danger for the patient, the best method of treatment for severe cases of asthma. This therapy is not possible, but the nearest approximation to it is tuberculin treatment. It may be remembered in this connection that Wagner von Jauregg, before beginning malaria-therapy for

general paralysis, tried tuberculin treatment for his patients and, although it did not give him all the results he hoped for, the action was clear enough to convince him of the correctness of the principle and to stimulate him to find more active agents which led him to the artificial infection with malaria. We did not know of von Jauregg's experiment with tuberculin when we began our treatment of asthmatics, and only later realized that we had followed the example of a great master.

Tuberculin treatment of asthma, then, has a sound basis, and as the method is without danger it is worth trying in most cases of allergy. For reasons which are still enigmatic to me, tuberculin treatment was received with considerable reluctance, even by those physicians who gladly injected their patients with large amounts of autovaccins, although asthma therapy with so-called autogenous vaccines has a poor theoretical foundation and, moreover, is more difficult in application and more apt to damage the patient than tuberculin treatment. Within the last few years the position has changed, and quite a number of asthma workers on the Continent and in America acknowledge the value of the method.

Differences of opinion, however, still exist about the percentage of cases suitable for this treatment and the percentage of cures, improvements, and failures. On this point, naturally, our knowledge is more extensive than it was ten years ago. Above all we have learned the limitations of the method and have obtained a better insight into its indications and contra-indications.

As has been pointed out above, practically all asthmatics derive temporary benefit from most infectious diseases. We may add that sulphur injections also which produce rise of temperature give almost always temporary relief to the asthmatic symptoms, and we know that various other substances which produce a similar reaction act in the same way. Knowing this, it would hardly be possible to believe that tuberculin treatment in a person sensitive to tuberculin would not benefit the patient, at least temporarily. Tuberculin treatment will have a beneficial effect in all asthma patients who give a positive von Pirquet reaction, and it has been proved by other workers and by us that most asthmatics do have a positive von Pirquet reaction, often even of considerable intensity. The beneficial action of tuberculin, however, may be diminished, or even abolished, by two factors which as a matter of fact, have the same influence on all other non-specific methods of treatment.

The first factor is the quantity of allergens which act on the patient at home and in his habitual surroundings. We have mentioned that even a severe illness like recurrent fever does not protect a patient who will be in permanent contact with large quantities of house allergens, and it may be expected that the much weaker tuberculin reaction will fail in such cases. Consequently the result of tuberculin treatment is for the most part dependent upon the hygienic conditions under which the patient has to live during and after treatment.

The second factor mentioned includes conditions of weather or "season," the exact nature of which are still unknown, but the influence of which is undeniable. We have noticed that every year in September and October the condition of about 45% of our patients is worse than it was during August. This bad period is not coincident with periods of influenza and colds, which as a rule come a little later and may also have an unfavourable influence on the course of asthma. This influence of season or weather is noticeable every year. During a short period, from August 8 to 10, 1931, however, it showed itself with dramatic severity and certainty. During these three days the condition of 65% of 300 of our asthmatics under treatment at that time was worse, and from statistics covering about 1,500 non-asthmatic people in Holland we gathered that about 10% of the Dutch population suffered from colds, sore throats, &c., during the same period. A large number of seemingly normal people had asthmatic symptoms at that time. This

observation proves that atmospheric conditions of unknown character and origin may produce a temporary deterioration in the condition of asthmatics, which tends to obscure the results of many of our methods of treatment, including tuberculin treatment.

In view of the fact mentioned and of our present knowledge, it is impossible to give an estimate of the percentage of cases of asthma which derive benefit from tuberculin treatment. We estimate the percentage of cases who *may* be benefited since they react to the drug as higher than 70%. The question, however, whether a certain group of patients will react favourably or not, is dependent upon the type of case, upon the quantity of active allergens in the daily surroundings and upon the influence of climatic and atmospheric conditions. As the treatment will seldom do harm, and then only temporarily, we still inject the greater part of our patients with increased doses of tuberculin during many months or even years, along with other therapeutic measures which we have learned more recently.

Other methods of non-specific treatment.—Injections of various substances produce a reaction in the human body which may improve the asthmatic condition. Although exact proof is lacking, it is highly probable that in all these cases the improvement is caused by the same factors which are active in natural fever and the nature of which is still unknown. It must be added, however, that although the principle of action may be the same, neither the intensity, nor the duration of the beneficial action in the case of non-specific treatment to be described is so great as in cases of natural or induced infections. In my opinion the choice of the substance in non-specific treatment is mainly dependent upon the question whether it may or may not do harm to the patient, and in this connection a sharp line has to be drawn between all substances of protein nature which may produce anaphylactic symptoms, and substances of non-protein nature which are devoid of this drawback. In my clinic a simple 0·5% solution of precipitated sulphur in oil is generally used. Intramuscular injection of 1 to 2 c.c. of this fluid usually gives a strong reaction with temperature up to 39° C. or higher; often the injection is repeated to keep the patient febrile for a couple of days. In rare cases the dose of sulphur has to be increased.

This method is simple and cheap, the solution being prepared in the laboratory of the clinic. The only drawback is pain, sometimes severe, which starts some hours after the injection and may last for from ten to twelve hours. Sulphur treatment seldom fails to give at least temporary relief of asthmatic symptoms, and I never knew it produce harm to the patient. Other preparations, including various commercial preparations, have the same effect; they often are more expensive and I have found in them no advantage over sulphur.

Röntgen-ray treatment probably acts in a similar way. Its results seem often to be good, but are not more permanent than those of other non-specific measures, and it cannot be repeated more than once without danger to the patient.

Various writers have attempted during the last few years to find an explanation for the beneficial action of non-specific therapy. As mentioned above, I consider all these hypotheses failures. The fact that non-specific treatment temporarily abolishes the allergic manifestation is beyond doubt, and everyone who treats allergic patients must take advantage of it.

Dr. R. S. Bruce Pearson gave a summary of skin reactions obtained in asthmatic patients and some control cases. The postulates on which a positive reaction was recorded were described. These consisted of an increase in the size of the wheal and in a surrounding area of erythema, which persisted for from 5 to 15 minutes. When intradermal tests were made 0·025 c.c. of solution was injected. Wheals without erythema and delayed reactions were not included.

Sixty asthmatics tested at the Guy's Hospital Asthma Clinic showed the following results:—

(1) Fifty-five per cent. gave a positive reaction to 1 : 100,000 "proteose" obtained from asthmatic urine.

(2) Sixty-nine per cent. gave positive reactions to a human hair extract.

(3) Forty-two per cent. were shown to be sensitive to one or more proteins (foods, epidermals) by the scratch method.

Twenty controls (healthy students) gave the following results:—

(1) Fifteen per cent. gave positive reactions to asthmatic urinary proteose, as above.

(2) Seventeen per cent. gave positive reactions to human hair extract. "Proteose" and hair were tested by the intradermal method.

A smaller series of 25 asthmatics showed that 60% reacted to their own individual proteose (1 : 1,000) while only 5% of 20 controls reacted to their own. This does not imply that there is any individual specificity, but that asthmatics as a group tend to pass urine from which a substance can be prepared to which they are sensitive, while this is not so in healthy persons.

If the asthmatics (60) were considered alone, two groups could be roughly separated: (1) a group sensitive to proteose (1 : 100,000) obtained from them or other asthmatics, and (2) a group not sensitive to proteose. Of the former group 98% gave positive reactions to human hair extract, 66% were sensitive to foods or epidermals; their average age was 24 and the average age of onset of symptoms was 10½ years. Of the non-sensitive group, 33% were sensitive to human hair, 4% to proteins; their average age was 36 and average age of onset 25 years. There was no sharp limiting line between these groups, which merged into each other.

Reasons were given for supposing that histamine was not the reactive substance in urinary "proteose" or human hair extract, although allergics are probably slightly more sensitive to histamine than are normal people.

Dr. John Freeman said he gathered from Dr. Oriel that he now regarded any specific sensitization to proteose as a sensitization on the part of the allergic person to his own damaged or denatured tissues; apparently that was Professor van Leeuwen's view also, and it seemed a reasonable hypothesis. Dr. Oriel quoted from other work that a man might be allergically sensitive to his own bruised tissues, and he, the speaker, believed that he had come across a number of instances of this. He would add that, if we were to regard as allergic phenomena the well-authenticated cases of violent urticaria after such chemically simple drugs as potassium iodide, we must consider that the subjects were not reacting to the drugs but to their own tissues denatured by the drug—in fact to "iodate of man." It seemed, therefore, perfectly possible for a man on occasion to become allergically sensitive to the waste products of his own metabolism; this, however, was very different from stating as a general rule that the allergic man always reacted to his urinary excrement, or that substances from this excrement, called proteose, must tally with the substances to which the person was sensitive; they might do so on rare occasions, but he, the speaker, had never found an instance.

Professor van Leeuwen's varied therapy was stimulating to thought, and the benefit to an asthma patient of artificial dengue fever, or of "Schlammfieber," was technically very interesting. He agreed that fevers produced by air-passage infections (such as pneumonia, bronchitis, whooping-cough—and, he would like to add, in spite of Professor van Leeuwen's exemption, bad colds—produced marked remissions in the asthma attacks, the freedom lasting sometimes for many months or even years. He had always supposed that, after duly discounting the psychological effect, this was due to the immunity induced by the infection. The patient

had previously, so to speak, had "hay-fever" due to a hay-field of pneumococci or streptococci growing in his own post-nasal space, and the acute attack by these micro-organisms had desensitized or immunized him to them. This seemed to be a strong argument for the use, in cases of asthma, of those autogenous bacterial vaccines which Professor van Leeuwen had rather deprecated.

Dr. George Bray said that with regard to recent work in America, Murphy and Cobe (*Journal of Allergy*, 1932, iii, 161) suggested that the active principle of the Storm test for allergic individuals using an extract of human dander was histamine. The hydrolysis of dander gives rise to many amines of which histamine is one; physiological tests with dander and histamine solutions give similar reactions; similar skin tests can be obtained with each; and both give a positive Zimmermann's colour reaction for histamine. It would be interesting to see if this work could be confirmed. The rôle of infectious diseases in childhood was interesting. In the majority of children in whom there was not a positive family history of allergy, one of these infectious diseases was the precursor of the allergic state. Again, it was interesting to observe that a later infection caused a cessation of the symptoms during the fever and for a variable period afterwards, but sooner or later the hypersensitive state returned. This led to the discussion of the value of "fever" therapy in combating the allergic state. This could be done not only by inducing attenuated infections but also by the use of diathermy. It had been tried extensively in America recently, and though some encouraging results had been obtained, the majority of cases relapsed, and the observers were forced to the conclusion that fever, *per se*, was not the whole story, especially if invoked by artificial means. (Feinberg, Osborne and Afremow, *Journ. Allergy*, 1930-1, ii, 414; Leopold and Stewart, *ibid*, 1930-1, ii, 425; Miller and Piness, *ibid*, 1930-1, ii, 436.) During the past year he (Dr. Bray) had obtained good results in severe cases of asthma in childhood which had resisted previous treatment, by the injection of a mixture of histamine and adrenalin, intradermally or subcutaneously, at weekly intervals, with the idea of provoking the secretion of adrenalin. With so many means of non-specific therapy one questioned whether it was the substance injected or merely the injection that caused the improvement.

With regard to Dr. Oriel's "proteose" injections, he, the speaker, wondered whether the results claimed were permanent, and whether the patients cited who were hypersensitive to various substances could come in contact with them again without symptoms following the course of injections. Patients waiting in queues at clinics talked to each other, and the fact that the doctor had told one patient to remove his feather pillow or to exclude certain articles from his diet, might lead to the advice being followed by all the patients; therefore the beneficial effects of injections might be due, not so much to the injections, as to the specific avoidance of causative allergens.

Professor Storm van Leeuwen (in reply): We have prepared proteoses from the urine of 24 asthmatic patients. The urine was voided during severe attacks of asthma. Skin reactions with the 24 proteoses obtained were negative in normals and sometimes positive in asthmatics. We could not find a preponderance of positive reactions in the patient whose urine had been used for the preparation of the proteose, so that there was no specificity in that sense. Of 24 proteoses, 9 gave positive skin reactions in some asthmatics, 6 gave slight reactions and 9 gave no reactions at all. Skin reactions with proteoses were made in 185 patients, and of those 13% showed positive reactions, 18% showed slight reactions, 69% were negative. Only in three instances did a patient react positively to his own proteose.

Our results then amount to this: that in some cases "proteoses" give positive skin reactions. The important question to decide is, whether these reactions have

to be considered as *allergic* reactions. Small difference in activity in different people will be observed with all drugs; such differences, however, are seldom of considerable intensity. The difference, however, between those people who do react and those who do not react to proteoses is so great that indeed we have a right to consider the reaction as of allergic nature.

To my mind the importance of Dr. Oriel's discovery is the fact that a human being may be sensitized to a product of the human body, probably a product of protein deterioration. Van Niekerk and I found, about ten years ago, that an extract of the epidermis of the human skin gave positive skin reactions in most allergics and negative reactions in most normals. Here again we have a hypersensitiveness of human beings to a product of the human body, a fact which may have some practical application but which is chiefly of theoretical interest.

Section of Odontology.

President—Mr. E. B. Dowsett, D.S.O., L.R.C.P., M.R.C.S., L.D.S.E.

[*March* 21, 1932.]

A Complex Composite Odontome.

By G. B. Pritchard, L.R.C.P.Lond., M.R.C.S., L.D.S.Eng., and H. H. Kenshole, L.R.C.P.Lond., M.R.C.S., L.D.S.Eng.

The patient, Harold B., aged 18½, had had a small hard lump in the upper right premolar region under the buccal mucous membrane for years. This had begun to increase in size about eighteen months ago. Three months ago the notice of the patient was drawn to it by a dental surgeon, and a radiographic examination was made. *Report*: "A complex composite odontome."

The patient had suffered no pain or discomfort in any way from the tumour, and no history could be obtained of the occurrence of similar conditions in other members of the family.

On examination, the dental arches were seen to be regular, except that the right maxillary canine tooth was instanding and articulated inside the mandibular arch and all third molar teeth were erupted. The patient thought that the last of these teeth had come into position two years previously. In the right maxillary premolar region there was a hard sessile tumour approximating to the size of a large almond-nut, the margins of which shelved off gradually into the surrounding alveolus. The superficial mucous membrane appeared normal, as did the teeth in this region, the latter being quite firmly implanted in their sockets.

Operation, February 11, 1931.—Local analgesia was obtained by infiltration of 3 c.c. of 2% solution of novocain. A rectangular flap of mucoperiosteum with its attached base uppermost was lifted, to expose an area approximately 1 in. in the horizontal direction by ¾ in. in vertical extent, in the middle of which was seen a raised mound covered by fenestrated alveolus, through the apertures of which there appeared numerous facets of a dentine—or enamel-like substance. By means of fissure burrs a semicircular slot was cut surrounding the tumour, to include a margin of alveolus all round, one end of the slot beginning opposite the root of the second premolar tooth, and the other opposite the root of the canine tooth. The depth of this slot was sufficient to sever completely the cortical bone of the alveolus, and upon the insertion of a periosteal elevator at the highest point of the semicircle the separated portion came easily away, leaving exposed the roots of the two premolar and canine teeth, which were also removed. Recovery was uneventful.

Report from the Dental Histology Laboratory, Guy's Hospital.

"This odontome was received entire with the bone covering its superficial surface *in situ*. Its deep surface had been in relationship with the roots of 543, from which it was separated by the connective tissue of its follicle. As a result, an investigation of the follicle, with special reference to its epithelial content, became possible. The specimen appeared to be a solid mass, with connective tissue adherent to its deep aspect, and a thin layer of bone adherent to, but not united with, its superficial aspect. It measured 12 by 8 by 14 mm.

Histological examination.—Two parallel slices, each $\frac{1}{16}$ in. thick, were taken transversely across the centre from the deep to the superficial surface. One was

prepared by grinding, after the surrounding bone had been shelled off (the bone was nowhere adherent). The other was decalcified, with the surrounding bone and soft tissues *in situ*, cut in celloidin, and stained for examination with hæmatoxylin and eosin.

The ground section. Slide A, fig. 1.—In appearance it conformed with the standard description of such a tumour. Enamel dentine and cementum occur in their developmental relationship to each other. The convoluted enamel-covered surface is on the deep aspect; the basal or radicular surface (although there is no root) is on the superficial aspect. In this region there is a thick localized area of very irregular vascular cementum. Only one other similar area occurs and over most of the rest of the surface is a regular layer of laminated cementum such as one sees at the root bifurcation of molars. Imbedded in the main area of the vascular cementum is a localized area of enamel with the prisms cut in varying directions.

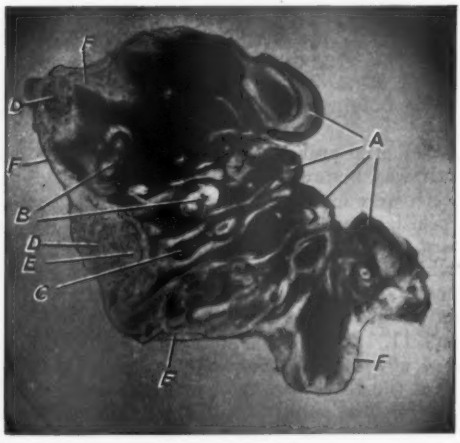

FIG. 1.—SLIDE A × 6 (APPROX.).

A. Enamel covered surfaces of dentine processes. *B*. Enamel covered clefts in the dentine cut transversely. *C*. Apex of cleft cut longitudinally lined with enamel and covered by an irregularly calcified cementum. *D, D*. Areas of vascular cementum. *E*. Isolated area of enamel with prisms cut transversely. *F*. Laminated cementum.

In the deepest convolutions there is calcified connective tissue with cells included, on the surface of the enamel it bears little resemblance to true cementum. There is slight granularity sporadically in the enamel and a few interglobular spaces in the dentine, but on the whole these tissues, with the cementum, appear to be well calcified.

The decalcified sections. Slides B, C, D, E.—A detailed comparison between the ground and decalcified sections cannot be made because they do not conform at all closely; but this is merely evidence of the complexity and irregularity of the infoldings of the formative epithelium. For the most part processes of dentine of perfect form are seen running in various directions and cut at different angles; with, in some places, a regular formation of granular cementum, and in others a more irregular deposit of calcified connective tissue arranged in contorted laminæ, deposited on them. Large empty spaces, from which the enamel has been completely removed in decalcifying, are present. Other similar spaces have considerable remnants of

decalcified enamel showing great regularity in the structure of the prisms. In one area, probably the basilar part, a very much more primitive arrangement of dentine and cementum is seen, with traces of extremely hypoplastic enamel. A narrow convoluted band of dentine with scanty tubes running in all directions and with crenated edges surrounds a series of empty spaces filled in the recent state with enamel. In this dentine also are areas some of which are filled with hypoplastic enamel; and other and smaller ones containing groups of enamel calcospherites. Other areas contain cementum formed or calcifying, or follicular tissue. The arrangement indicates an extreme and most irregular infolding of a part of the formative organ followed by an incomplete effort at calcification (fig. 2).

The follicular tissues.—The connective tissue is that usually found in the follicle of a developing tooth (figs. 3 to 6). The epithelium presents many points of interest. In the deepest and narrowest fissures of the enamel the epithelium has the same features that are seen in Nasmyth's membrane in the deep fissures of a developing premolar. It is many cells thick. The cells are flattened in contact with the enamel, and rounded and swollen, with the intercellular bridges well marked, in the centre of the strand. Here the staining reaction is poor (D, fig. 3). On

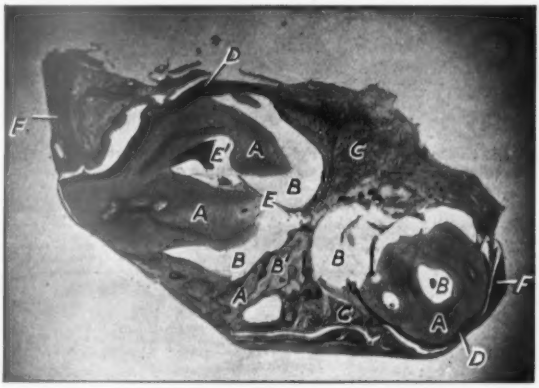

FIG. 2.—SLIDE B × 6 (APPROX.).

A. Dentine. *B*. Areas originally containing enamel. *B'*. Decalcified enamel remnants. *C*. Follicular tissue containing many epithelial rests. *D*. Cementum. *E*. Narrow band of follicular tissue with Nasmyth's membrane on its surface passing into a deep fissure to join up with *E'* (shown more highly magnified in fig. 3). *F*. Bone.

other and superficial areas of the enamel the membrane is seen either as an even layer several cells thick (B, fig. 4) or keratinized. In one area, possibly due to obliquity in cutting the incompletely degenerated epithelium, the membrane appears double, while between the layers is a compact mass of cells flattened externally and rounded in the centre, completely isolated and surrounded by dead debris. The free epithelial rests are varied. Large irregular masses are seen with prolongations running among the connective tissue fibres (D, fig. 4). Other masses of cells in columns spring from Nasmyth's membrane and run into the follicle (D, fig. 5).

Of the groups of cells in rounded masses, there are a very large number to be seen scattered irregularly among the fibres of the follicle. Some of these have keratinized. Others appear to have calcified. There are many isolated masses of calcification in the follicle, some of which lie in groups. They appear to be composed of cementum, and there are indications of further calcification actively in progress to produce their fusion (fig. 6).

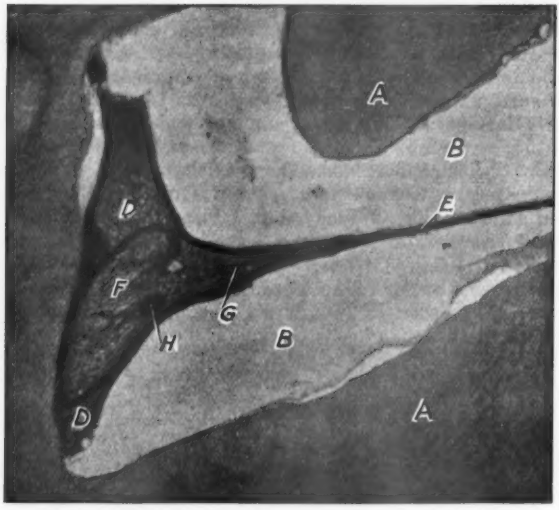

FIG. 3.—SLIDE C × 65 (APPROX.).

A. Dentine. *B*. Enamel areas. *E*. Follicular tissue with Nasmyth's membrane superficially. *D*. Degenerating epithelium. *F*. Follicular tissue. *G*. Vessel. *H*. Irregular calcifying mass.

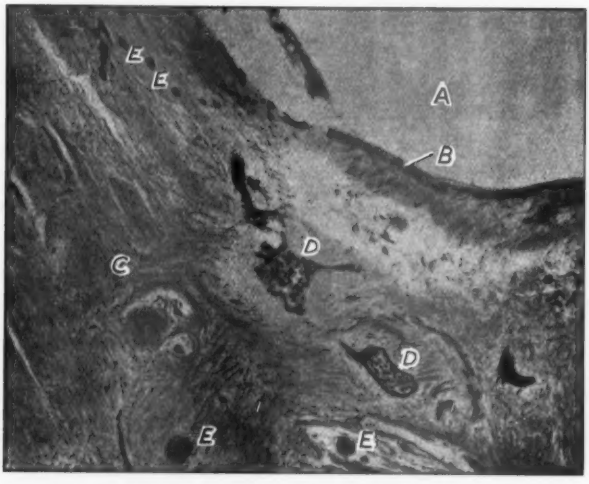

FIG. 4.—SLIDE E × 200 (APPROX.).

A. Enamel area. *B*. Nasmyth's membrane. *C*. Follicular tissue. *D*. Irregular epithelial rests with ? growing processes. *E*. Epithelial rests in latent form.

Some of these masses have a definitely laminated nucleus, quite distinct from the cemental covering, which appears to be of epithelial origin.

Comment.—A consideration of the possibilities of further growth of such a tumour

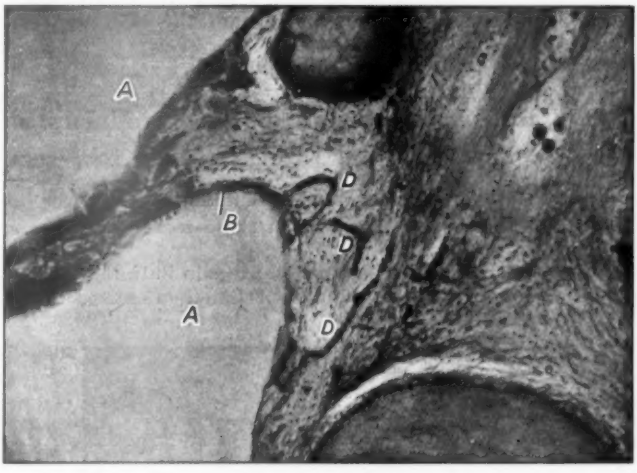

FIG. 5.—SLIDE D × 200 (APPROX.).

A. Enamel area. *B*. Nasmyth's membrane. *D*. Columns of epithelial cells springing from Nasmyth's membrane to run into the follicle.

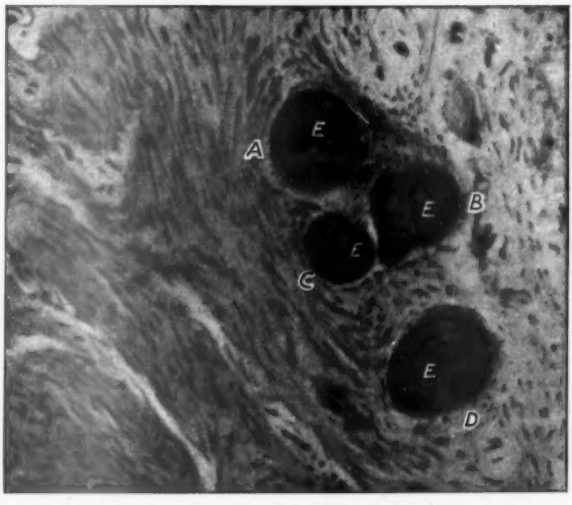

FIG. 6.—SLIDE B × 350 (APPROX.).

Calcified masses in the follicle composed superficially of cementum. *A*, *B*, *C*. Beginning to fuse. *E*. Their central nuclei.

is interesting. It appears that the formation and calcification of the main mass of dentine and enamel has come to an end. There is evidence that the formation of cementum is still in progress in the basilar part—cementum of a developmental and

not an inflammatory type. Sporadic calcification in isolated areas, both in epithelium and connective tissue, is occurring and it seems possible that such calcification, if continued, might unite these masses with each other and with the main mass. Figure 6 shows three such masses being fused together. Also, in any such tissue where the epithelial rests of Malassez are so abundant, there is always the possibility of the formation of epithelial cysts."

[*Photomicrographs by G. A. Walker, Guy's Hospital.*]

A Case of Two Buried Lower Molars.

By J. Draper Cambrook, L.R.C.P., M.R.C.S., L.D.S.

Some years ago, I saw a patient who was edentulous in the upper jaw, but had 754321 | 1234 in the lower jaw. I extracted these teeth and fitted a full lower denture.

Two years afterwards, the patient began to have pain in the left shoulder and arm, which later spread to the left side of the chest. She then noticed that there was a

tooth erupting in the left lower molar region. I examined the mouth, and discovered what was presumably an erupting molar with its occlusal surface directed backwards. A skiagram was taken and showed two buried molars, presumably ⌋78, with their crowns in opposition and that ⌋7 had come into view by the absorption of the overlying bone (see fig.). I operated and chiselled away the surrounding bone, but even when there was a clear opening I could not detach them. One of them was so firmly attached to the bone that it broke during its removal but finally both of them were removed satisfactorily. The patient's recovery was quite normal and the pain in the arm, shoulder, and chest wall gradually disappeared. This condition of buried molars with their crowns in opposition is very rare. Mr. Frank Coleman reported two cases here about two years ago.[1] In both those cases also there was an intimate connection between the teeth and the bone and considerable difficulty was experienced in removal.

[1] *Proceedings*, 1930, xxiii, 1461 (Sect. Odont., 37).

Section of Ophthalmology.

President—Mr. ELMORE W. BREWERTON, F.R.C.S.

CLINICAL MEETING, HELD AT THE LONDON HOSPITAL, ON MARCH 11, 1932.

Mr. CHARLES GOULDEN, F.R.C.S., showed the following cases:—

(I) Shot-gun Wounds of Right Eye: Commotio Retinæ.

T. P., aged 17. Male.

History.—1.11.31. Whilst out shooting rabbits received a barrel-load of shot at 40 yards range.

On admission.—Right eye showed swelling and bruising of lids; conjunctival hæmorrhage; no perforating wound: commotio retinæ; small detachment of retina. Skiagram showed presence of pellets (fifteen in all), two in orbit, two in cheek, three in scalp, and several in arms and hands. Four were removed under local anæsthesia.

15.11.31. Discharged from ward; ordered instillation of atropine twice daily.

3.12.31. Extensive concussion changes in outer half of retina. Large atrophic areas and hæmorrhages; macular region showed disintegration of pigment with folds.

31.12.31. *Vision*: Right = ^{6}; with 1·00 sph. = $\frac{6}{6}$; left = $\frac{6}{6}$.

(II) Traumatic Myxœdema: Lens Opacity.

Patient, a woman, aged 29, had been operated upon at the age of six years for a thyroglossal cyst. This was apparently the only thyroid tissue she possessed, as her development was much retarded after the operation. At sixteen years she was given thyroid feeding, and has taken thyroid tablets ever since; at present she takes 4 grm. daily. She is only 52½ in. in height, but in spite of her bodily deformity—bow-legs and so on—is mentally quite alert. Vision right and left, with correction, = $\frac{6}{6}$. With a slit lamp the following conditions may be observed: The various bands of discontinuity are well seen, and are as one expects in one of her age. The spaces between the anterior and posterior capsules and the corresponding zone of disjunction are apparently clear, as also the adult and fœtal nuclei. Lying between the anterior and posterior zones of disjunction and the surface of the adult nucleus are two types of opacity: flattened blue disc-like opacities, similar to those in blue-dot cataract, and as the beam of light is moved from side to side there are brilliantly glistening angular opacities, green and blue in colour, such as are attributed to the presence of crystalline substances (e.g. cholesterin), but without histological proof.

(III) Diabetes Mellitus and Synchisis Scintillans.

Patient, female, aged 59. I removed the left lens from this eye for cataract, and subsequently needled the capsule. As a result, a small amount of vitreous prolapsed into the anterior chamber. The interest of the case lies in the fact that there is synchisis scintillans, and some of the glistening bodies have prolapsed with

the vitreous into the anterior chamber, and so are visible with a loupe, and still better in focal light with the microscope. It will be seen that these bodies are not crystalline in character, showing that the condition is not due to the presence of cholesterin. Vision with this eye is $\frac{6}{6}$.

(IV) Coloboma of the Right Optic Disc.

(V) Tay's Choroiditis (Right Eye), Tay's Choroiditis (Left Eye), with Retro-retinal Hæmorrhage.

Patient, female, aged 60. Vision, right, $\frac{6}{12}$; left, fingers. Blood-pressure, 190/75. Arterio-sclerosis.

At a meeting of the Ophthalmological Society held at the London Hospital seven years ago, I showed a case of retro-retinal hæmorrhage, the only one I had seen up to that time. The patient I show to-day is suffering from arterio-sclerosis, and in the right eye there is an appearance of Tay's choroiditis. In the left eye there is a similar appearance, but in the region of the macula there is a plum-coloured swelling, pushing the retina before it, over which the retinal blood-vessels are seen, but altered in this respect that they retain a bright reflex but are dark red in colour. This appearance is exactly similar to the case I previously reported, except that in that instance there were angioid streaks. I have frequently seen that patient; he subsequently developed glaucoma, for which I operated, but the areas affected in the fundus have developed into patches of atrophy, so that central vision has been lost.

(VI) Subconjunctival Rupture of Right Eye. Subconjunctival Prolapse of Iris: Dislocated Lens. ? Berger's Capsular Layer in Pupil. Good Vision.

Patient, male, aged 55.

Blow with fist on right eye, January, 1930. Subconjunctival rupture of sclera involving about half of circumcorneal area 3 mm. from limbus; lens in bottom of vitreous; much vitreous hæmorrhage.

Right vision: with $\frac{+\ 11{\cdot}00\ \text{D.sph.}}{+\ 2{\cdot}5\ \text{D.cyl.}\ 90^\circ} = \frac{6}{9}$.

Healed flattened scar concentric with corneo-sclera margin; apparently large coloboma in inner part; thin pellicle across pupillary area in which is a gap through which the vitreous protruded into anterior chamber. This pellicle is covered with fine pigment granules as is also the vitreous. A few large vitreous floaters; no sign of lens can be found.

Nothing abnormal in fundus.

At the last Clinical Meeting at the Royal Eye Hospital, I showed two cases[1]: (1) A degeneration and peeling off of Berger's zonular layer of the anterior capsule which had produced glaucoma; (2) a peeling-off of the zonular layer in a man who had been a chef for forty-seven years. In the second case, the appearance was that sometimes associated with heat cataract. It has been seen in glass workers and was seen in a case I showed some years ago of a retort charger at a gas works. Cases have been said to occur in which the lens has been dislocated into the vitreous by injury and has apparently left its anterior capsule in the pupillary area. As in some of these cases the lens had remained clear for a long time there could not have been a serious rent in the lens capsule, otherwise we should have had signs of traumatic cataract.

The present case is remarkable in that, in spite of extremely serious injury, the eye retains such good vision.

(VII) Foreign Body in Right Cornea.

Patient, male, aged 49, road maker.

5.11.28.—Hit in right eye whilst chipping stone.

1 *Proceedings*, 1932, xxv, 688, 689 (Sect. Ophthal., 26, 27).

On examination.—Small corneal abrasions; small spot of blood in anterior chamber; foreign body in angle. Fundus normal. Vision, right $\frac{6}{36}$.

9.11.28.—Attempted removal of fragment by Haab's giant magnet. Fragment remained immovable. Skiagram negative.

17.11.28.—Discharged; condition unchanged.

20.12.28.—Vision (right) $\frac{6}{9}$ with glasses.

4.5.31.—No change.

I have not thought it necessary to interfere in this case, as the embedded foreign body is causing no inconvenience and would, I think, be difficult to remove.

VIII. Drusen (Right and Left Eyes).

Patient, male, aged 26.

September, 1931.—Rheumatic fever; in bed two months. Some eye pain then.

January, 1932.—Left eye "turned in" and patient saw double.

January 25, 1932.—First attended hospital; no diplopia; no deviation, full movements. Vision (right and left) $\frac{6}{6}$; improved to $\frac{6}{5}$ with glasses.

February 11, 1932.—Much pigment arranged in circles at periphery of fundi; all deep to retinal vessels. Discs and maculæ normal. Probably drusen.

Mr. T. COLLYER SUMMERS said that the patient had been examined with monochromatic light and no diminished sensation to monochromatic blue had been found. Such diminished sensation was always found in cases of retinitis pigmentosa.

IX. Siderosis.—This is the case of a boy who was injured some months ago. He did not notice much wrong at first, but three weeks ago he came to hospital with early signs of siderosis in the lens, which had become opaque, with small particles of brown pigment. An intraocular foreign body is revealed by X-rays, but the magnet does not dislodge anything. There is a wound of the cornea, and the foreign body is inlaid. I shall probably extract the lens.

Discussion on Mr. Goulden's Cases.—Mr. RANSOM PICKARD said that since the last meeting Mr. Hawker had shown him a case which he, the speaker, recognised under the slit-lamp as one of chronic glaucoma due to this trouble in the lens capsule, the other eye having acute glaucoma. The media were too opaque for him to see what was the matter in the latter, but the first eye showed little fragments on the lens, one of which disappeared later in the day; he thought it had become detached and carried out to the angle of the anterior chamber.

A few weeks ago he had had a case which he had seen ten years before and had then diagnosed as one of sclerosis of the iris; there were several yellowish patches on the iris, and at that time there was glaucoma. The patient then disappeared, and was seen again a few weeks ago for the first time after ten years. The naked-eye appearance of the condition was much the same as formerly, but slit-lamp examination showed a number of deposits on the iris, one very large. He, the speaker, was not sure whether this condition was the same as that just described, because on two or three of these patches on the iris some blood-vessels could be seen. He thought the fragments of the lens capsule had become fixed on to the iris, and that blood-vessels had since developed from the stroma of the iris and had entered into this mass. As one would expect after ten years of glaucoma, the patient had now a blind eye.

Mr. HARRISON BUTLER said that separation of the zonular lamella took place under several conditions. One was irido-cyclitis, another after accident, and in a third it was a senile manifestation. The case shown by Mr. Goulden (Case VI) was an excellent one, but it was unusual in that the common condition after dislocation of the lens was that the anterior lamella contracted out of the way. In the *Transactions of the Heidelberg Congress* there was a drawing by Meesmann in which the zonellar lamella was up in the periphery. He had seen two cases in which after dislocation of the lens it was in that position. He believed that when a dislocated lens was examined one rarely found the fibrils of the zonule attached to it, and almost always when the lens was dislocated by accident it tended to leave the zonular lamella behind. The term "zonular lamella" should be applied to the peripheral part of the lamella and a new name given to the anterior part.

Since the last meeting he, the speaker, had had an interesting case in a man whose work was hardening steel. He had always worn tinted glasses at his work. He had not got heat cataracts or rather infra-red cataracts, but there was a peeling off of the superficial layer of the capsule. The man was probably suffering from this, owing to his work as a steel temperer; only the central part of the zonule was detached. To get a good view he, the speaker, dilated the eye with homatropine, and glaucoma developed in both eyes. That in the right eye cured itself before the patient was seen again, and that in the left was cured fairly easily with miotics. Then another attack of glaucoma developed in the left eye, and this yielded to pilocarpine. He, Mr. Harrison Butler, then performed iridencleisis with success.

Even with a central detachment a strong tendency to glaucoma had developed, whereas that was not the type of eye in which he would have expected it. Fuchs had seen lamellation of the capsule in connection with some of his microscopical sections. He, the speaker, had published one case in his "Guide to the Slit-Lamp," and he had seen another in a boy who had chronic irido-cyclitis. In that case the lens had gone back and shrunk, and over the pupil was a distinct thin membrane, similar to that figured in the book.

This question of the association of glaucoma with desquamation of the capsule should be kept in mind, as these conditions were probably more common than was usually supposed. If the causes were overlooked, the right treatment would probably not be adopted.

Mr. ROWE JEREMY, with regard to the case of siderosis, said that a Canadian soldier during the late war had a piece of iron in his retina, near the optic disc, and he, the speaker, did not think it advisable to remove it, as the vision was $\frac{6}{12}$. The patient returned two years later with a cataract in the same eye. Under X-rays it was found that the piece of iron had disappeared. There was siderosis over the iris and in the lens. He, Mr. Jeremy, removed the cataract; the patient did well, and his vision was good.

Mr. H. ROWE JEREMY, F.R.C.S., showed the following cases:—

I. Corneal Opacities in Three Sisters.

The patients are three sisters aged respectively 12, 9 and 6 years. I showed the eldest child at a meeting of the Ophthalmological Society some years ago. There were two children born previously and their corneæ were normal, and since this third case the mother has had another child whose corneæ are clear. The oldest of these patients has a more opaque cornea than the youngest. With a $-1{\cdot}0$ D. lens she has vision $\frac{3}{60}$. At the Ophthalmological Society Meeting it was suggested that the condition might be due to interstitial keratitis or infantile glaucoma, but the Wassermann reaction of both child and mother was negative, and there were no signs of blood-vessels, or any inflammatory condition. I think the origin of the condition was endocrine deficiency in the mother, after the European war.

Mr. T. HARRISON BUTLER said he examined the larger child with the slit-lamp, and found that the thickness of the cornea was twice what it should be. The epithelium was normal, but the cornea was abnormal throughout. It was an interstitial change unlike that of interstitial keratitis, in which the condition began at the back, the part under the epithelium being clear. There was, however, a general turbidity of all the lamellæ of the cornea.

II. Myotonia Atrophica, with Cataracts.

This patient was 22 years old when I first saw her, and she had increasing muscular atrophy. Her mother and grandmother had the same disease. I removed the cataract from the right eye in 1921, and during the operation there were adhesions between the iris and the capsule, but vision was $\frac{6}{6}$ and J.1, with glasses, after the operation. In 1922 I operated on the left eye, performing a preliminary iridectomy, and later extracted the cataract. The patient did well afterwards, vision being $\frac{6}{6}$ and J.1. There is no specific treatment for this disease, but the interesting point is that in over 50% of cases there are cataracts, and if these are removed the patients see fairly well.

Mr. C. GOULDEN said that these cases were now more frequently recognised; they were originally described by Mr. Gibb. The opacities in the lens had a peculiar appearance in the

early stage; they usually set in between the ages of 20 and 30, and the cataract matured unusually early: most of the patients died comparatively young. Tiny angular opacities were crowded together in the superficial part of both anterior and posterior cortex under the anterior and posterior zones of disjunction. Scattered among these whitish opacities were many iridescent crystalline bodies.

When operating upon these cases, the lens could be removed without preliminary needling by making an incision in the cornea with a keratome, splitting the lens capsule, and washing out the opaque material with warm normal saline solution.

Mr. J. H. DOGGART, F:R.C.S., showed the following cases:—

(I) Vitreous hæmorrhage.

C.H., male, aged 31, woke up on January 1, 1932, to find that his right eye was almost blind. Three days later he attended hospital.

On examination.—A large, irregular-shaped hæmorrhage obscured the central portion of the fundus. Numerous hæmorrhages in the periphery; evidence of obstruction in many of the veins. Similar peripheral venous obstruction and hæmorrhages in the fundus. Vision.—Right: finger counting; left: $\frac{6}{18}$ obtained with correcting lenses. General health always good. No other abnormality detected in Medical Out-patients Department.

The right vitreous is now full of blood, so that the fundus is no longer visible. Partial absorption of the left fundus hæmorrhages has occurred, and left corrected vision is now $\frac{6}{6}$. With the slit-lamp numerous floating particles can be seen in each aqueous and vitreous. In the left eye the arcuate line and the hyaloid remnant are plainly visible on the posterior capsule of the lens.

Mr. C. GOULDEN said he did not think that this was a case of Eale's disease; it was more likely one of ruptured aneurysm with subarachnoid hæmorrhage. He had seen the patient soon after the loss of vision, and thought that the condition was possibly due to arteriosclerosis. General examination, however, failed to show any disease of the blood-vessels. When he saw the case again, the appearance had altered a great deal and there was not the same interference with the retinal circulation.

(II) Atrophy of Irides.

W. S., male, aged 60, came to the London Hospital in February, 1932, suffering from a left subconjunctival hæmorrhage which has since become absorbed. Vision in the right eye has always been poor. He can only count fingers with this, an amblyopic eye. Corrected vision in the left eye is $\frac{6}{5}$.

There are numerous pigment granules on the posterior surface of each cornea. Both pigment borders show advanced disintegration, and some of the scattered dots have become deposited on the stroma of the irides. Owing to the marked degree of atrophy, the sphincters are plainly visible. In the right eye, when the beam is directed to the nasal border of the pupil, light shines through horizontal slits in the nasal portion of the iris, as a result of atrophy of the retinal pigment layer. In both lenses the relief of the adult nucleus is a prominent feature.

[I am indebted to Mr. C. B. Goulden for permission to show these two cases.]

Mr. T. COLLYER SUMMERS, F.R.C.S., showed the following cases:—

(I) Conical Corneæ.

Patient, female, aged 29.

History.—Eyes have never been inflamed. Vision always defective; glasses never advised; has never had any treatment of eyes. Eight years ago and three days after birth of a child had a feeling of cold in the right eye.

Acne rosacea + +.

On examination.—Right eye: Descemetocele covered with epithelium and having many small staining spots. Left eye: tension − 1; many small ulcers on bulging

surface. Ring of blood-vessels round bulging part of cornea with vessels leading up to it in both eyes, all conjunctival in origin.

(II) Pituitary Adenoma.

Patient, female, aged 22.

History.—First seen, July 14, 1931. Fields showed complete bi-tempo ra hemianopia to quantitive perimetry 1° red (fig. 1).

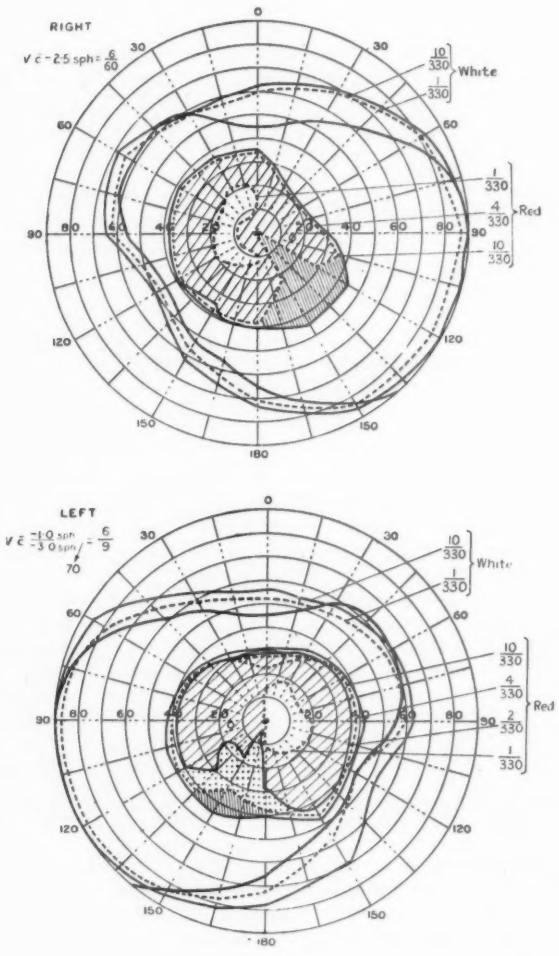

FIG. 1.

Operation (Mr. Hugh Cairns) July, 20, 1931.—Right transfrontal route. Incomplete removal of cystic and solid adenoma; almost complete recovery of visual fields (fig. 2).

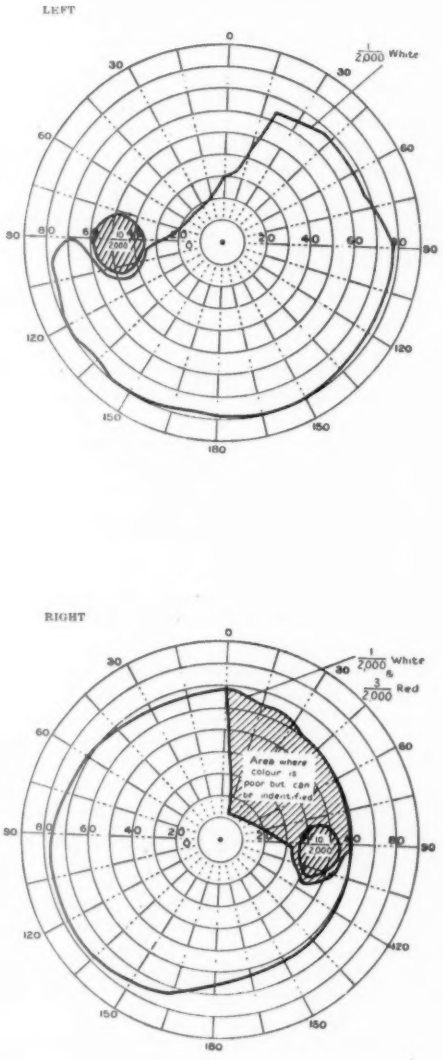

FIG. 2.

Mr. HUGH CAIRNS, F.R.C.S., showed the following cases:—

(I) Glioma of Third Ventricle and Optic Chiasma. (Unverified.)

(II and III) Chromophobe Adenoma of Pituitary Gland.

(IV) Cavernous Hæmangioma of Region of Optic Chiasma.

(V) Cyst of Rathke's Pouch.

Mr. BISHOP HARMAN showed an ingenious and useful device for preventing back-glare from the sight-hole of an electric ophthalmoscope. It consisted of a small tube set through the hole, the lower edge of which protruded sufficiently to shield the hole from the light, and so prevent any glare entering the observer's eye.

Mr. TUDOR THOMAS demonstrated its adaptation to the electric retinoscope, and said that it made use of the instrument easier and more reliable, especially with an undilated pupil.

The President and others present spoke of its value.

Section of Otology.

President—Mr. NORMAN PATTERSON, F.R.C.S.

[*May* 6, 1932.]

Post-Operative Labyrinthitis. Subsequent Meningitis. Recovery after Vestibulotomy without Meningeal Drainage.—DAN MCKENZIE, M.D.

Female, aged 45. Chronic suppuration left middle ear. After five years' simple treatment, radical mastoid operation for headache, some vertigo and increasing discharge. Tympano-mastoid spaces very small and cramped, but no important structures exposed. No labyrinth fistula found. Grafted. Twenty-four hours after operation (January 23, 1929), signs of labyrinthitis: violent vertigo, vomiting, spontaneous nystagmus, and temperature 101° F. Symptoms all subsided within four days. But a fortnight later signs of meningitis appeared: headache, vomiting, mental dullness, cervical rigidity and temperature up to 103° F. Immediate double vestibulotomy after diagnostic lumbar puncture (cerebrospinal fluid showed leukocytosis and bacteria). The internal meatus was not opened nor were the meninges otherwise drained. Rapid recovery from the meningeal symptoms. But subsequent progress was very slow.

After the patient left hospital, vertigo on sudden movement, together with occasional occipital headache, persisted for two years. The presence of saccus empyema was feared, but after consultation during her acute illness, with Dr. C. O. Hawthorne, and later with Dr. C. P. Symonds, it was decided not to explore. A small eroded sequestrum was extruded from the meatus twelve months ago, and thereafter discharge became less. The ear is now dry.

Fistula Symptom in Simple Acute Otitis Media.—DAN MCKENZIE, M.D.

Girl, aged 14, seized with double earache during a cold. Pyrexia for over a week. No ear discharge. Three weeks later the left ear had recovered, but the right remained deaf, with an occasional twinge of pain, and there was dull, occipital headache at night. One day the patient was seized with vertigo so violent that she had to go to bed. Giddiness, more or less severe, lasted five days, with occasional vomiting and continuous nausea. When she was in this state she could make the vertigo violent by "putting her finger in her ear."

When first seen by the exhibitor five weeks after the onset of the trouble, the membrane of the right tympanum was congested round the margin, in Shrapnell's area, and down the handle of the malleus. The membrana vibrans was yellowish in colour, and showed meandering blood-vessels. There was no sign of perforation, recent or old, and no bulging. The mastoid region was not tender, and there was no œdema. Temperature 99° F. No cerebellar or meningeal signs. The deafness was "obstructive" in character, but the fistula symptom was pronounced. Increase of air-pressure in the right meatus caused an immediate dart of the eyeballs upwards and to the right, together with forced movement of the head to the left.

The mastoid was opened and drained, and paracentesis performed the same day. The bone was highly vascular; the lining of the cells was œdematous, but no pus was seen.

Slight spontaneous nystagmus was noted for a few days after operation, but rapid recovery followed, with healing of the membrane and restoration of hearing to normal.

Chronic Suppurative Otitis Media with Cholesteatoma: Acute Labyrinthitis and Meningitis. Recovery after Radical Mastoid Operation.—T. B. JOBSON, M.D.

12.4.32.—R. L., male, aged 24, admitted to hospital with meningitis. Onset of symptoms four days ago, after eating some sausages, when he had nausea, vomiting, diarrhœa and headache. The aural condition was recognized and he was transferred from the medical to the aural side.

His left ear had discharged since he was 7 years old and had never been treated.

On admission.—Throbbing pain in back of head; earache of three days' duration; vomiting; giddiness—falling to left on standing. Definite head retraction and pain in neck-muscles on trying to bend head forward, superficial and deep reflexes normal. Marked nystagmus on turning eyes right. No hearing in left ear with Bárány control. Temperature 99°. Pulse 104.

Cerebrospinal fluid:—

The fluid is turbid with cells and there are a good many red cells. Total cells, 7,150 per c.mm. *Differential count:* Polymorphonuclear leucocytes, 72%; lymphocytes, 20%; endothelial cells, 8%.

Direct films.—Pus is present in large amount (+++) but bacteria are not seen.

Cultures.—No growth on inspissated egg or on hæmoglobin agar.

Operation (same day).—Radical mastoid. Meatus was full of foul pus and cholesteatoma. No external redness or swelling. Bone over mastoid was acellular. Antrum small and well forward. Lateral sinus close to antrum exposed and found healthy. Dura exposed; also healthy. Middle ear full of cholesteatoma. Fistula seen in external canal. Pus welled up when antrum was opened as if under pressure. Patient improved rapidly after operation although temperature rose to 103° on third day. Giddiness, headache, head retraction lessened daily. Nystagmus remained marked for over a week. Patient finally made an excellent recovery.

Cerebrospinal fluid (14.3.32).

A slightly opalescent fluid with some white clotted material.

Total cells	2,267 per cmm.
Differential count—	
Polymorph. leucocytes	92%
Lymphocytes	5%
Endothelial cells	3%

Total proteins.—150 mgm. per 100 c.c. *Dextrose content.*—Very much reduced. *Chlorides.*—740 mgm. per 100 c.c. *Organisms. Direct films.*—A *very* occasional pair of pneumococci is seen. A few staphylococci. *No streptococci. Cultures.*—There is no growth on inspissated egg or on hæmoglobin agar.

16.3.32.—The specimen is slightly turbid. Alkaline.

Total cells	105 per cmm.
Differential count—	
Polymorphonuclear leucocytes	65%
Lymphocytes	33%
Endothelial cells	2%

Total proteins.—100 mgm. per 100 c.c. *Dextrose content.*—Much reduced. There is practically no reduction of Fehling's solution. *Organisms. Direct films.*—The direct films show only a very occasional pair of pneumococci and a few staphylococci. *Cultures.*—Both inspissated egg and hæmoglobin agar give an occasional colony of pneumococci and a few colonies of *Staphylococcus albus.* A very poor growth on all media.

Blood-count (18.3.32).—R.B.C. 4,470,000; Hb. 90%, C.I. 1·0; W.B.C. 8,000. *Differential.*—Polys. 68%; Eosinos. 2%; Large monos. 16%.

It will be noted that this patient recovered from a definite attack of labyrinthitis with meningitis after a free radical mastoid operation, without operation on the labyrinth.

Discussion.—Mr. J. F. O'MALLEY said that Dr. Jobson was to be congratulated on the excellence of the result in this exceedingly interesting case, inasmuch as there had been labyrinthitis and meningitis of purulent nature, and yet the patient had recovered, though merely a mastoid operation had been performed. The view had steadily become general that when meningitis was a sequence of labyrinthitis it was desirable to open the labyrinth. But here was a case in which the labyrinth had not been opened, and yet the patient had survived. It was interesting that in the examinations of the cerebro-spinal fluid the polymorphonuclear leucocytes were diminished on the second occasion, and the lymphocytes increased; this feature was now beginning to be regarded as a good prognostic sign.

Mr. F. WATKYN-THOMAS asked whether any note had been made of the chlorides present at the first examination of the cerebro-spinal fluid; it was not stated in the printed notes. He noticed that at the examination on March 14 the chlorides were 740 mgm. per 100 c.c.; this was above the danger figure for suppurative meningitis, which was accepted as 680 mgm. per c.c.

Dr. JOBSON, in reply, said that in the small number of cases in which he had opened the labyrinth he had not experienced success, and he was pleased when this case showed signs of improvement immediately after the mastoid operation, and it was not necessary to open the labyrinth.

No note was made as to the chlorides present at the first examination.

Although the cultures were sterile on April 14, yet on April 16 the direct film showed pneumococci and staphylococci, and the cultures on egg albumen and agar gave pneumococci and a few colonies of staphylococci. It was curious in this case that certain features in the cerebro-spinal fluid seemed to develop after the operation, and showed a delayed appearance. The organisms were found four days after the mastoid operation, at which time the patient was showing definite improvement. The dextrine content, even on April 16, was much reduced, so that there was practically no reduction of Fehling's solution. He believed that the amount of sugar in the cerebro-spinal fluid was considered to be a very early sign of meningitis, preceding the finding of micro-organisms in the fluid. But here, four days afterwards, there was practically no dextrose, and the patient was considerably better than before the first examination. He was too ill for the coloric test to be applied, and the labyrinth was "dead," so probably there would have been no response to that test. With the Bárány box in the right ear, a loud shout could not be heard in the left—the affected—ear.

Cholesteatoma which performed a Radical Operation.—N. ASHERSON, F.R.C.S.

Patient, a woman, aged 25, has had a chronic discharge from both ears for many years.

She has not had any operation, and the right ear shows, on examination through the speculum, extensive destruction of the posterior meatal wall, showing the same effect as if a radical operation had been performed.

The ear is perfectly dry and there are no symptoms except deafness.

Keloid in Post-aural Scar, treated with Radium. Cure.—HAROLD KISCH, F.R.C.S.

The cortical mastoid operation was performed May 19, 1930. The keloid developed gradually later; it measured $3\frac{3}{4}$ by 4 in. by $\frac{3}{4}$ in.

Radium was inserted in one-milligramme needles under gas-anæsthesia. The doses were as follows:—

28.1.31, 2 needles 35 mgm. hrs.	25.3.31, 4 needles 480 mgm. hrs.
11.2.31, 3 needles 79 mgm. hrs.	29.11.31, 2 needles 182 mgm. hrs.

Discussion.—Mr. HERBERT TILLEY said that post-aural keloid scars had been successfully treated at the Radium Institute for many years by the application of a radium varnish. The results were no better than those in which Mr. Kisch had employed radium needles, but the former might be more easily obtained than the latter.

Mr. SYDNEY SCOTT said that occasionally keloids were cured spontaneously.

Mr. W. STUART-LOW agreed that these scars might be improved for a time, but ultimately they became bad again. He had had such scars excised, and the cases had done well.

Mr. J. F. O'MALLEY said that if to assist the healing of a mastoid operation wound, it was exposed a few times to ultra-violet rays the scar was an unusually good one.

The PRESIDENT said that the application of X-rays to scars must be carried out with care. In a large number of cases of lupus treated with X-rays at a time when dosage was not understood epithelioma had developed.

Labyrinthitis, a Complication of Middle Ear Suppuration: A Clinical and Pathological Study.

By A. LOGAN TURNER, M.D., F.R.C.S.Ed., F.R.S.E., and J. S. FRASER, M.B., F.R.C.S.Ed.

(*From the Ear and Throat Department of the Royal Infirmary, Edinburgh*).

TREATMENT AND RESULTS.

THIS paper forms the third and concluding portion of our work upon labyrinthitis. Part I dealing with the clinical aspect of the subject (A.L.T.) appeared in the *Journal of Laryngology*, xlii, 1927, p. 22, and Part II, dealing with the Pathology of Labyrinthitis (J.S.F.) in the same journal, xliii, 1928, p. 609. The whole of the work has been based upon our experience in the Ear and Throat Department of the Royal Infirmary of Edinburgh; Parts I and II during the years 1907-1925 inclusive, while Part III—that now under consideration—covers the years 1907-1931 inclusive, a period of twenty-five years.

STATISTICAL DATA.

The following figures represent the material coming under review during the period 1907-1931.

I. *Cases of middle ear suppuration.* — Acute, 4,098; Chronic, 10,381; Total 14,479.

Mastoid operations: 2,905, i.e., 20% of the total cases of middle ear suppuration attending the Department. In acute middle ear suppuration, 1,066, i.e., 26% of acute cases. In chronic middle ear suppuration (radical and modified radical operations), 1,839, i.e., 17% of chronic cases.

II. *Labyrinthine complications.*—These were diagnosed in 216 cases, i.e., in 1·5% of 14,479 cases of middle ear suppuration. This total, however, includes 22 cases of labyrinthitis following the radical mastoid operation, the so-called "induced" labyrinthitis. Hence the actual number of cases of "spontaneous" labyrinthitis in the whole series was 194, i.e., almost 1·4% of the total cases.

Labyrinthitis complicated 25 cases of acute middle ear suppuration, i.e., 0·6% of 4,098 acute cases.

Labyrinthitis complicated 191 cases of chronic middle ear suppuration, i.e., 1·8% of 10,381 cases. It is necessary, however, to deduct from this group the 22 cases of induced labyrinthitis, thus leaving 169 cases of spontaneous labyrinthitis i.e., 1·6% of the cases of chronic middle ear suppuration.

III. *Intracranial complications.*—Complications were already present in 50 of the 194 cases of spontaneous labyrinthitis when the patients were admitted to hospital, i.e., in 25% of the cases of labyrinthitis. The intracranial complications were as follows:—

	Cases
Extradural abscess (middle fossa)	1
Temporal lobe abscess and lepto-meningitis ...	6
Cerebellar abscess	3
Thrombosis of transverse sinus ... . (4 with lepto-meningitis, 1 with cavernous sinus thrombosis and 1 with cerebellar abscess)	15
Lepto-meningitis	25
	50

Of these 50 cases 13 recovered, 4 of the 13 being cases of purulent lepto-meningitis.

Types of Labyrinthitis.

Various methods of classifying labyrinthitis have been suggested; of these, two have been adopted by us in Parts I and II of this investigation, the first founded on a clinical basis, the second upon the method or route of infection of the labyrinth from the middle ear.

Clinical types of labyrinthitis.—The following types occurred:—

	Cases
(*a*) Circumscribed labyrinthitis	59
(*b*) Serous following circumscribed	2
(*c*) Circumscribed in latent stage of acute purulent on admission to hospital	47
(*d*) Acute serous labyrinthitis	4
(*e*) Acute purulent labyrinthitis	47
(*f*) Chronic latent labyrinthitis	34
(*g*) Spontaneous cure of labyrinthitis	23
	216

From the point of view of surgical pathology we may divide our cases into (A) those due to bone erosion, i.e., starting as so-called fistula cases, and (B) those due to infection through the oval or round windows or both.

(A) *Bone erosion labyrinthitis*—117 *cases.*

(1) Circumscribed labyrinthitis only—52 cases: all recovered.

(2) Circumscribed labyrinthitis with intracranial complication on admission—7 cases of which 1 recovered and 6 died.

(3) Serous labyrinthitis following circumscribed—two cases: both recovered.

(4) Acute purulent labyrinthitis following circumscribed—9 cases: of these, 4 had lepto-meningitis on admission and all recovered.

(5) Latent labyrinthitis following circumscribed—47 cases: of these 47 patients, 12 had intracranial complications on admission (6 recoveries and 6 deaths). Of the 35 remaining cases, 33 recovered and 2 died of meningitis.

(B) *Window infection labyrinthitis*—99 *cases.*

(1) Serous labyrinthitis—4 cases: all recovered.

(2) Acute purulent labyrinthitis—38 cases: of these 9 had an intracranial complication on admission: 1 recovered and 8 died. Of the remaining 29 cases, 18 had post-operative (induced) labyrinthitis: 10 recovered and 8 died. In the 10 cases which recovered, a skin graft was applied at the time of the radical mastoid operation in 6 cases. There was no skin graft in 4 cases. In the 8 cases which died a skin graft was applied in 4, and no skin graft in 4 cases.

(3) Latent labyrinthitis—34 cases. Of these, 14 had intracranial complications on admission: 1 recovery and 13 deaths. Among the 20 remaining cases without spontaneous intracranial complication, 19 recovered and 1 died from post-operative cerebellar abscess.

(4) Spontaneous cure—23 cases. Of these, 4 were admitted with intracranial complications and all died. The remaining 19 recovered.

General Summary: Recoveries and Deaths—216 Cases.

(A) *Labyrinth cases not associated with intracranial complications on admission.*

(1) "*Spontaneous*" *labyrinthine disease:*—		Recoveries	Deaths
Circumscribed labyrinthitis	50	50	0
Circumscribed, admitted in latent stage of acute purulent ...	35	33	2
Acute serous labyrinthitis	4	4	0
Acute purulent labyrinthitis	16	15	1
Chronic latent labyrinthitis	20	19	1
Spontaneous cure of labyrinthitis	19	19	0
	144	140	4

97·3% recoveries

(2) *Post-operative ("induced") labyrinthitis :—*					
Acute serous following radical mastoid operation in circumscribed labyrinthitis	2	...	2	...	0
Acute purulent labyrinthitis following radical mastoid operation	20	...	12	...	8
	22	...	14	..	8
63·6% recoveries					
(B) *Labyrinth cases admitted with intracranial complications.*					
Total ...	50	...	13	...	37
Recoveries 26%					

Commentary.

Diagnosis of labyrinthitis.—There are two weak spots in the diagnosis of labyrinthitis. There is, firstly, the question of "serous" labyrinthitis. It is usually held that if the patient can still hear with the noise-box going in the good ear, even though giddiness and vomiting with nystagmus to the sound side are present, the case is still to be considered one of serous labyrinthitis which may recover without operation on the labyrinth. In one or two of our fatal cases following the radical mastoid operation the labyrinth operation was delayed because the patient could still hear with the noise box in the good ear. In such cases it would probably be better to open and drain the labyrinth by the Hinsberg operation rather than to run the increased risk of meningitis from delaying the operation.

The other weak spot in the diagnosis is the question of the date at which latent labyrinthitis may be regarded as having passed into the stage of "spontaneous cure." It is not always possible to get a clear history from the patient with a dead labyrinth as to a previous attack of giddiness, vomiting, loss of balancing, and apparent rotation of external objects. Undoubtedly if he can give a history of such an attack within a period of six months before his visit to hospital, it is wise to regard the case as one of latent labyrinthitis and to drain the labyrinth at the time of the radical mastoid operation. If, on the other hand, the patient gives a history of an acute attack of labyrinthitis at a period of say a year or more before his visit, then it is presumably safe to consider the case as one of spontaneous cure and to omit the labyrinth operation. There is, however, a certain number of cases in which no such history can be obtained, and in these circumstances the line of safety is to regard the patient as suffering from latent labyrinthine suppuration and to operate accordingly.

Circumscribed labyrinthitis or labyrinth fistula.—We hold that in these cases the question of performing the radical mastoid operation only should depend on the amount of hearing in the ear under consideration. If the hearing is good, e.g., whisper heard at two feet or more, it is advisable to perform the radical mastoid operation only and to watch the case carefully for symptoms which indicate that the circumscribed labyrinthitis is becoming diffuse. We have, however, seen three cases in which the symptoms of a labyrinth fistula continued, i.e., the patient complained of giddiness on turning quickly or on stooping after the radical mastoid operation alone had been carried out, and in one of these, at least, a second operation had to be performed, involving destruction of the inner ear.

On the other hand, if the hearing in the ear under consideration is bad, it is better to perform the Hinsberg labyrinth operation at the time of the radical mastoid operation.

We are aware that Bárány operates on cases of circumscribed labyrinthitis with the aid only of local anæsthesia, presumably for the reason that the patient can in these circumstances give warning when the region of the fistula is interfered with. We, however, have never attempted to carry out the radical operation under local anæsthesia, though we have used this method in cases of mastoiditis following acute middle ear suppuration in diabetes.

Acute purulent labyrinthitis.—In cases of acute labyrinthitis complicating acute purulent middle ear suppuration but without indications for the Schwartze operation we have adopted the waiting policy; that is to say the patient has been kept at rest in bed in hospital for a period of four weeks, the case meanwhile being closely watched for any rise of temperature or onset of headache. In cases of acute labyrinthitis complicating chronic purulent middle ear suppuration, however, we have adopted the more active policy of opening and draining the labyrinth by means of the radical mastoid and Hinsberg operations.

Latent labyrinthitis.—There can be no doubt but that if the radical mastoid operation is called for in a case with latent labyrinthitis, the labyrinth should be opened and drained at the time of the radical mastoid operation. In several instances pus was present in the lateral canal and also in the vestibule, while in others granulation tissue was found in these situations. It is noteworthy that in several cases of latent labyrinthitis there was no active nystagmus to the opposite side after operation. We take this to mean that the function of the affected labyrinth in these cases had been lost for a considerable period. In the majority of cases, however, there was well-marked nystagmus to the sound side after operation.

Spontaneous cure of labyrinthitis.—Little remains to be said with regard to cases of spontaneous cure of labyrinthitis. Several of the patients showed only scars and chalk patches in the drumhead at the time of their visit to hospital but gave a history of an attack of labyrinthitis many years before, and functional examination showed that the affected ear was entirely deaf and that the caloric reaction was absent. The rotation test, however, demonstrated that an equal degree of nystagmus was produced by rotation to the right and by rotation to the left. In other words, the compensation phenomenon (Ruttin) was present.

In the cases of spontaneous cure in which the condition of the middle ear called for the radical mastoid operation, no labyrinth operation was performed.

Induced labyrinthitis.—As will be seen from the general summary, the mortality in cases of so-called spontaneous labyrinth disease was a comparatively small one, namely, four deaths in 144 cases—a mortality of 2·7%. In post-operative or induced labyrinthitis on the other hand, i.e., labyrinthitis following the radical mastoid operation, with or without skin graft, the mortality was much higher, namely, eight deaths in 22 cases—a mortality of 36·4%. Of the eight fatal cases a skin graft was applied in four and no skin graft in four. Details of five of the eight fatal cases have already been published by Dr. J. P. Stewart and one of us (J. S. F.) in the *Journal of Laryngology and Otology*, vol. xlv, 1930, pages 114 to 118.

These cases of induced labyrinthitis have undoubtedly an adverse effect upon our results and we should be glad to know whether other otologists have had similar misfortunes. These catastrophes raise the question of the danger of applying a skin graft at the time of the radical mastoid operation. Even after the most thorough radical operation and after syringing out the cavity with sterile saline solution, we cannot be sure that all infective material has been removed from the neighbourhood of the windows. If a skin graft—which undoubtedly is a water-tight membrane—is then applied over the inner wall of the operation cavity, we blanket the region of the oval and round windows, thus favouring the occurrence of induced labyrinthitis by infection through the annular ligament or through the secondary tympanic membrane. In order so far as possible to avoid this occurrence, it has been the practice of one of us (J. S. F.) during recent years to cut a small hole in the skin graft before applying it to the inner wall of the operation cavity, so placing the graft that the hole lies opposite the window region. On the other hand, several of our cases of purulent labyrinthitis following the radical mastoid operation were cases in which no skin graft was applied.

What occurred was as follows: On the day following the radical mastoid operation it was reported that the patient had been giddy and excessively sick, that there was marked nystagmus to the sound side, and that he was either quite deaf or almost deaf with the noise box going in the good ear. Undoubtedly the wisest course to pursue in these circumstances is to take the patient at once to the operating theatre, open up the wound, remove the packing and open and drain the labyrinth by the Hinsberg operation. Cases in which this procedure was followed have as a rule recovered; those in which the operation was delayed for another day, because it was found that there were just slight remains of hearing with the noise box going in the good ear, have, on the other hand, succumbed to meningitis.

In two of the cases in which the patient died from meningitis after the radical mastoid operation, a pathway of infection had been opened up before the operation on the ear. In one of these the pathway was due to an old fracture of the skull and in the other to an operation by a general surgeon for removal of the Gasserian ganglion.

Cases of Labyrinthitis having Intracranial Complications on Admission.

As might be expected, our results in these cases were much less satisfactory than in those in which the labyrinth only was affected. The patients with intracranial complication on admission numbered fifty, of whom thirteen recovered (26%) and 37 died (74%). Among the thirteen recoveries there were four in which we found that purulent leptomeningitis was present on admission. We must admit, however, that the diagnosis of purulent leptomeningitis is still a matter of controversy. The late Sir William Milligan held the view that a case could only be regarded as one of purulent leptomeningitis when, in addition to pus cells, organisms were present in the lumbar puncture fluid. We do not think, however, that many otologists will support this view. It seems to us to be an undoubted fact that if a patient has considerably elevated temperature, intense headache, retraction of the head, positive Kernig and Babinski signs and purulent fluid on lumbar puncture, the case is one of purulent leptomeningitis. We agree with Jenkins' view that leptomeningitis may be compared with abscess formation elsewhere and that though living organisms and pus cells are present in the neighbourhood of the internal meatus in cases of meningitis following labyrinth infection, in more distant regions such as the lumbar spine there are only pus cells but no living organisms. In this connection we may state that it is our view that the most favourable cases of meningitis are those which follow labyrinthitis and, if the internal acoustic meatus be promptly opened and drained according to the method of West and Scott, the prognosis is far from hopeless. Cases of meningitis associated with septic sinus thrombosis, for instance, are much less favourable.

We have never held the view that there is a close association between labyrinthitis and cerebellar abscess. As will be seen from the table on page 121, there were only three cases in which cerebellar abscess was present among the fifty cases in which an intracranial complication existed on admission. It is interesting to note that there were six cases of temporal lobe abscess, which is usually said to be twice as common as cerebellar abscess.

Facial paralysis after operation.—In the 104 cases dealt with during the years 1926 to 1931 (inclusive) nine of the patients on whom the labyrinth operation was performed suffered from facial paralysis before operation: In two cases facial paresis or paralysis appeared after the radical mastoid operation only had been performed, in five after the radical mastoid and Hinsberg labyrinth operation and in sixteen following translabyrinthine drainage. We do not, however, think that facial paresis or paralysis after the labyrinth operation is very unusual, certainly not in those cases in which the translabyrinthine drainage of West and Scott is carried out in addition to the labyrinth operation.

Complete closure of the skin wound.—We have been informed that in Vienna the practice in cases of labyrinthitis is to leave the posterior wound unstitched and to allow the operation cavity to granulate. This is undoubtedly the safest course to pursue, but we believe that if at the end of five days after operation in a case of labyrinthitis, the patient is free from fever, vomiting, headache, etc., it is permissible to perform secondary suture of the mastoid wound.

Congenital syphilitic cases with Hennebert's sign.—In two of our cases, not included in the present report, a diagnosis of circumscribed labyrinthitis was made because the fistula symptom was present. The Wassermann reaction, however, was positive, and the patients were undoubtedly suffering from congenital syphilis. At the operation no fistula in the lateral canal was discovered. As far as we know, the explanation of Hennebert's sign is still disputed, but many consider that it is due to undue mobility of the stapes.

Diagnosis of meningitis during operation.—In some cases in which meningitis was suspected on admission, lumbar puncture was not performed until the radical mastoid operation had been completed, and the inner wall of the middle ear and dura mater of the middle and posterior fossæ had been inspected. At this point the patient was turned on to his side, lumbar puncture performed and cloudy cerebrospinal fluid under considerable tension evacuated. The patient was then turned again on his back and the labyrinth operation and translabyrinthine drainage carried out. It was noteworthy that in these cases there was a very slight flow of purulent fluid from the internal meatus instead of the profuse gush of fluid which is obtained when the translabyrinthine operation is carried out without lumbar puncture. This fact is not very surprising, but it certainly shows that lumbar puncture does drain off a considerable quantity of fluid from the lateral cistern.

Duration of nystagmus after operation.—In several cases we have found that the nystagmus lasted for more than fourteen days and, in one instance, the patient still suffered from giddiness six weeks after an attack of acute purulent labyrinthitis had been treated by the conservative method, i.e., without operation.

Discussion.—Mr. SYDNEY SCOTT showed some of his own slides, including several which he had shown more than twenty years previously, when some aural surgeons had scarcely met with a single case of labyrinthitis.

He related some experiences in which the symptoms had been mistaken for those of other diseases; on one occasion for those of cerebral hæmorrhage, or cerebellar abscess, so that unnecessary exploration of the brain was undertaken. As many cases terminated in meningitis, the symptoms caused by labyrinthitis had formerly been attributed to the early symptoms of meningitis.

Mr. Scott said that even in recent years the giddiness and sickness had been mistaken for signs of gastric influenza. The distress from vertigo in some patients had been mistaken for hysteria until the rapid onset of signs of meningitis led the observer to correct his diagnosis too late.

On the other hand, post-operative labyrinthitis might be overlooked, especially in children, if the possibility were not kept in mind.

Labyrinthitis, if limited to the vestibule and canals, did not necessarily cause profound deafness, and Weber's test lateralized sometimes to the diseased side in spite of otitis interna.

He believed that the use of translabyrinthine draining for lepto-meningitis was limited to those cases in which the meningitis was a sequel to labyrinthitis, and was not indicated in cases of lepto-meningitis unless the labyrinth had been the path of infection. He still believed in practising repeated lumbar puncture, as well as translabyrinthine drainage.

Dr. DAN MCKENZIE said that the most striking fact which emerged from the present enquiry was the lowness of the mortality from labyrinthitis, a rate at which he was surprised. It was marvellous that there should have been 97% of recoveries; even in the acute and purulent, and in the latent cases, the fatalities were not more than 5% or 6%.

He did not claim that his own results were any better than those of the Edinburgh workers, but when a number of experts were doing a particular operation for a particular

disease, the rate of case recovery was practically the same for all. So it could be said that the results achieved by otological surgeons in general in operations for labyrinthitis were good.

The great difficulty about labyrinthitis from the clinical point of view was to know when to interfere, or whether to interfere operatively at all.

Another point was as to the suspicion or the occurrence of saccus empyema in a case of "dead" labyrinth. In the case he was showing to-day the labyrinth operation had been performed, but a particular kind of vertigo continued. It created in the patient a feeling of uncertainty as to what would happen if she suddenly turned a corner; a momentary staggering occurred, after which she became all right again. Another symptom which was present was occipital pain on the homolateral side. He had hesitated as to whether the posterior fossa should be opened in order to reach the saccus, but decided not to open it.

Mr. WATKYN-THOMAS said it was admitted that labyrinthitis could be spontaneously cured, but if one compared the results when the labyrinth was left to itself with those in which the condition was dealt with surgically, there were twenty-three spontaneous cures, and fifty patients who came with intracranial complications. The mortality was 5% when surgical treatment was obtained, 26% when it was left to cure itself. The logical conclusion was that labyrinthitis was a definite surgical condition and needed surgical treatment; it should not be left to cure itself.

The second point was the high death-rate in the induced post-operative labyrinthitis. He did not know whether any evidence had been found as to what the method of immunizing the labyrinth was, but there must be some means by which the labyrinth could protect the meninges, probably by blocking of the internal auditory meatus and of the aqueduct of the cochlea. He believed that the high mortality of induced labyrinthitis in acute otitis media was due to the failure of this blocking.

On one point he was not clear, on Mr. Fraser's reading, namely, whether he accepted the equal nystagmus in both directions (Ruttin's reaction) as an indication of cure of a dead labyrinth.

Did the authors of the paper think that a radical mastoid operation was always necessary in circumscribed labyrinthitis? He (the speaker) had seen three cases of fistula of the external canal which healed after an extended Schwartze operation.

Mr. THACKER NEVILLE said that he had found bulbo-capnine to be of value in acute labyrinthitis. In a boy, aged 14, he was compelled to expose the cerebrum and the cerebellum. In exposing the latter there was very little room, and he opened the posterior canals. He could see the openings as at the Neumann's operation. The boy was put back to bed and had nystagmus to the opposite side, and vomiting. He could not take food. He (the speaker) injected bulbo-capnine, whereupon the vomiting ceased and the giddiness was greatly reduced. He wondered whether in that case Mr. Fraser would have performed a complete labyrinth operation?

After a month a Kisch muscle-graft was inserted into the wound. The boy was now well except that pressure on the external auditory meatus resulted in giddiness. When a large wound was left after a labyrinth operation, a Kisch temporal muscle-graft with pedicle was a convenient and quick way of closing it. Such a muscle-graft ought not to be applied after a labyrinth operation until the wound was lined with granulations. In the ordinary way a large wound might take from four to six months to heal well, but the Kisch procedure reduced the time to two weeks. In a recent case he (Mr. Thacker Neville) had performed labyrinthectomy in a case of tinnitus; this had cured the tinnitus but left a facial paralysis. A fascia lata graft which surrounded the eye was very successful in keeping the eye closed. A graft was also put to the upper lip, the corner of the mouth and the lower lip; this was a more successful procedure than nerve anastomosis.

Mr. J. F. O'MALLEY said that he had been struck by the greater number of radical mastoid operations than those in acute cases. In the last few years he found that the number of acute mastoids he did was ten to one against the radical. That might be because the ear conditions in the last twenty-five years were more efficiently attended to, and many of the cases did not reach the stage when they needed a radical mastoid operation, as compared with those a number of years ago. With regard to the diagnosis of serous labyrinthitis, he had long regarded this term as one of the weak points in the nomenclature of labyrinthitis. He could visualize the pathological change going on in a circumscribed labyrinthitis; he regarded it as an inflammatory process without any serous or purulent fluid addenda. In the more diffuse labyrinthitis, involving the whole labyrinth, the classification

made was "diffuse serous labyrinthitis" and "purulent labyrinthitis"; and, apparently, the diagnosis was not clinched until the result of the case was finally known. It was assumed, when a case went on to a satisfactory result, leaving a certain modicum of function in the labyrinth, that it was serous, but when the labyrinth was blotted out it was purulent. From the pathological point of view, however, that was not a satisfactory way of looking at it. It might be that what was regarded as serous was an acute inflammatory condition which had not produced anything beyond inflammatory engorgement, and that the more severe one had gone on to suppuration. The same remark applied to meningitis: textbooks now described a serous meningitis and a purulent one. Boenninghaus, forty years ago, was responsible for that classification, but he (the speaker), found it difficult to get the evidence on which that nomenclature had been based. Perhaps Mr. Fraser would elaborate the point in his reply.

Mr. ERIC WATSON-WILLIAMS asked what was the proportion of spontaneous recoveries in ordinary labyrinthitis? He understood that the danger of serious complications was very great and therefore when the diagnosis was confirmed he operated.

With regard to induced labyrinthitis, what should be done if one inadvertently opened the labyrinth during an operation? Personally he favoured leaving things alone; but in view of the high death-rate in induced labyrinthitis, was this view correct?

As to fistula, what proportion of these cases could be diagnosed before operation? In only half of the cases he had seen was the fistula sign evident before operation.

If fistula was present in the external canal, how should one deal with it? Should the vestibule be eviscerated? The teaching was to leave the fistula alone, but whereas the patient who had undergone a rapid vestibulotomy lost his vertigo, the patient in whose case the fistula had been left alone, often continued to suffer from vertiginous attacks for a long time. The essential step to prevent vertigo after labyrinthotomy was a careful curettage of the ampullæ and saccule. If the sensory end-organs were completely destroyed there was next day no vertigo when the patient was at rest, and at the end of ten days the patient was able to walk with his eyes shut.

Vertigo or even a little nystagmus after a radical mastoid operation did not necessarily imply the existence of labyrinthitis; it might be due to too tight a dressing. His own plan was to make sure that the patient could turn over in bed without becoming giddy; if he could do this he was not suffering from labyrinthitis.

Upon what features should one rely in deciding to proceed to trans-labyrinthine drainage? Many cases of meningitis following labyrinthitis seemed capable of recovery after vestibulotomy alone; and cistern drainage entailed certain obvious risks. In making this decision one could not depend on the presence or absence of living organisms in the lumbar-puncture fluid, as this was not known until the next day, by which time the opportune moment for intervention might have passed.

Mr. A. D. SHARP asked what was the correct procedure in traumatic labyrinthitis. Most members must have had under their care children whose labyrinths had been damaged by over-zealous parents attempting to remove a foreign body from the ear. Two months ago a child was admitted to hospital under his care, with all the symptoms of labyrinthitis—violent vertigo, vomiting, nystagmus, etc. Two days before admission, the mother had attempted to remove a bead from the ear, using a knitting needle. The bead was pushed through the membrane, damaging the inner wall of the middle ear. Under conservative measures the child recovered, except for the damage to the hearing.

Did Dr. Fraser advocate operation in all cases in which there was evidence of a damaged labyrinth?

Dr. LOGAN TURNER, in reply, said that the 216 cases of labyrinthitis diagnosed formed 1·5% of the cases of middle ear suppuration, but they did not represent the total cases of labyrinthitis. There were two reasons for this. (1) In 1907-8 these cases were only just beginning to be diagnosed. With the necessary apparatus, diagnostic precision had been achieved in regard to the cochlea, but the caloric response and the rotatory responses were not always tested. Hence at that period a definite proportion of cases of labyrinthitis must have escaped attention. (2) In the middle of the 25-years period some of these cases were diagnosed by the microscope but not clinically. In a large number the patients had died from intracranial complications present on admission. At that time Mr. Fraser was very active in his microscopical examinations, and the type of labyrinthitis was only recognized after death.

Mr. J. S. FRASER, in reply, said that with regard to Dr. McKenzie's remark concerning saccus empyema, he, the speaker, did not recognize this as a clinical entity. He had made microscopical sections of about forty inner ears in cases of suppurative otitis media and labyrinthitis and in only two was saccus empyema present.

In reply to Mr. Watkyn Thomas, he accepted equal nystagmus after rotation to the right and rotation to the left (Ruttin's compensation phenomenon) as an indication of the spontaneous cure of labyrinthitis. Further, he believed that at least a radical mastoid operation was indicated in cases of circumscribed labyrinthitis. As stated in the paper, he thought that the Hinsberg labyrinth operation was advisable in those cases of labyrinth fistula in which the hearing was bad.

He wondered how long the vomiting had continued in the case described by Mr. Thacker Neville. Possibly Mr. Thacker Neville gave the bulbo-capnine when the acute symptoms, e.g., vomiting and giddiness, were, in the normal course, passing off.

His colleague and himself had certainly had three cases in which patients with a fistula symptom, who had only had a radical operation complained, after the operation, that giddiness on turning and stooping still continued—in other words, little or no good had been done by the operation. In those instances a second operation was indicated, to destroy the labyrinth. If the hearing in the affected ear was not good, the patient relied on his sound ear. By the Hinsberg operation, which was nearly free from danger, one could destroy the function of the vestibular portion on the affected side, and so free the patient from giddiness on turning and stooping.

Mr. O'Malley had remarked on the large number of radical operations which he, the speaker, had performed, and the comparatively small number of Schwartze operations. The explanation was, not that more radical than Schwartze operations were performed in the Department, but that most of the latter were performed by the assistant surgeon, the clinical tutor and occasionally by clinical assistants under supervision. The Sister in the Department knew that he (Mr. Fraser) was keen on the radical mastoid operation and therefore reserved such cases for him.

He agreed with what had been said as to serous labyrinthitis. In the specimen which he was showing, the middle and apical coils of the cochlea were occupied by curdled lymph (serous labyrinthitis) which he regarded as the early stage of acute purulent labyrinthitis. If the inflammation became worse, pus would be present in all the coils of the cochlea; but if the disease stopped at the serous stage, the patient might recover with some hearing.

In answer to Mr. Watson-Williams' question as to operation for acute suppurative otitis media with labyrinthitis, on the whole he did not recommend operation in those cases. If a patient was admitted with acute middle-ear suppuration, nystagmus to the sound side, giddiness, etc., he was kept at rest in bed and closely watched for three or four weeks. If, however, such a patient required a mastoid operation, not only the radical operation—but also the Hinsberg operation—must be performed.

As to what should be done if the labyrinth was opened accidentally at operation, he recommended the Hinsberg operation. If the stapes had been loosened or had come away, the safest course was to go on and drain the labyrinth by double vestibulotomy.

In reply to Mr. Sharpe's question, he would say "Don't interfere; watch the case carefully." If the function of both parts of the inner ear was lost, it was safer to operate. If it was only a question of a knitting-needle passing through the tympanic membrane and injuring the inner wall, he would not be prepared to operate at once on the labyrinth. (The PRESIDENT: In the event of unexpected damage to the semicircular canal at the operation?) He did not remember injuring the lateral canal at the radical mastoid operation but he would consider his answer to that question. The same procedure would apply: Watching the case carefully, employing the noise-box and if deafness was absolute, performing double vestibulotomy.

A Case of Simultaneous Bilateral Labyrinthitis.

By J. S. FRASER, M.B., F.R.C.S.Ed.

(From the Laboratory of the Royal College of Physicians, Edinburgh.)

WILLIAM I., aged 70, seen 27.2.29 complaining of pain and difficulty in swallowing. An operation on the left tonsil had been performed by another surgeon in July, 1928. There was a history of left-sided otorrhœa in December, 1928, and the patient still complained of some pain in the left ear.

Examination showed the region of the left tonsil to be occupied by a hard, ulcerated mass which extended downwards towards the pyriform fossa. Otoscopy showed mild otitis media in the left ear.

12.3.29.—Throat sprayed with cocaine and six radium needles inserted: external application of radium plaque over enlarged glands in the neck. 15.3.29—Needles removed. 16.3.29.—Patient discharged but readmitted 24.3.29 complaining of earache, giddiness and profound deafness: both ears discharging: drumheads bulging: slight bilateral mastoid tenderness; no fever; slight nystagmus both to right and to left (? normal). 27.3.29.—Headache: temperature 100° F. 28.3.29.—Temperature 103° F.; no rigor, no giddiness and no vomiting: complete deafness in both ears. Lumbar puncture released cloudy, almost purulent fluid under great tension. (Wassermann reaction of cerebrospinal fluid negative; *Streptococcus hæmolyticus* on culture.) Operation considered hopeless. 29.3.29.—Death.

Post-mortem.—Extensive purulent lepto-meningitis, more marked over the vertex than at the base.

Microscopic examination of right ear.—Middle ear cleft: There is pus in the Eustachain tube. The tympanic membrane is markedly thickened, the lining mucosa being infiltrated and engorged. There is a double perforation of the anterior part of the drumhead. The head of the malleus and body of the incus are surrounded by swollen, engogred, infiltrated mucous membrane. The tympanum itself is full of pus. The round window niche is filled with pus, as is also the sinus tympani. The secondary tympanic membrane is perforated. The mucous membrane of the niche of the oval window is also swollen and infiltrated with pus cells. The stapes is slightly loose in the oval window and pus is entering the vestibule around the footplate. There is spongification of the bone in the anterior margin of the oval window. The vessels of the fossa subarcuata are engorged and surrounding the vessels there are small cells which are probably pus cells. The lining membrane of the mastoid and perilabyrinthine air cells is swollen, engorged and infiltrated (figs. 1 and 4).

Cochlea.—There is a large collection of pus in the scala tympani, just internal to the perforated secondary tympanic membrane. The cochlear end of the perilymphatic aqueduct is full of pus. There is more pus in the scala tympani than in the scala vestibuli of the basal coil. On the whole there is more pus in the cochlear than in the vestibular part of the labyrinth. The modiolus and spiral ganglion are infiltrated with pus; indeed pus from the internal meatus is infiltrating into the scala tympani of the basal coil in the region of the spiral vein of the cochlea. In the scala media one can still see remains of Corti's organ, but the membrana tectoria is separated from Hushke's tooth. The middle and apical coils of the cochlea only contain curdled lymph (figs. 3 and 4).

Vestibule.—Pus is infiltrating into the vestibule through the annular ligament, both anteriorly and posteriorly. The utricle is ruptured. The cavity of the saccule is full of pus. There is well-marked purulent infiltration in the perilymph space of the vestibule and there is also some pus in the ductus endolymphaticus.

Canals.—The semicircular canals are less affected than other parts of the labyrinth. There is a little curdled lymph in the endolymphatic space of the ampullary end of the superior canal. The epithelial cells of the cristæ of the superior and lateral canals are desquamating, and there is a small abscess in the branch of the vestibular nerve to these canals. The convexities of the superior, lateral and posterior canals are practically normal (fig. 2).

Internal meatus.—The subarachnoid space of the internal meatus is crammed with pus cells. The nerves in the internal meatus are surrounded by pus (figs. 2 and 3).

Microscopic examination of left ear.—Middle ear cleft: There is great swelling and engorgement of the drumhead, affecting not only the mucosal but also the

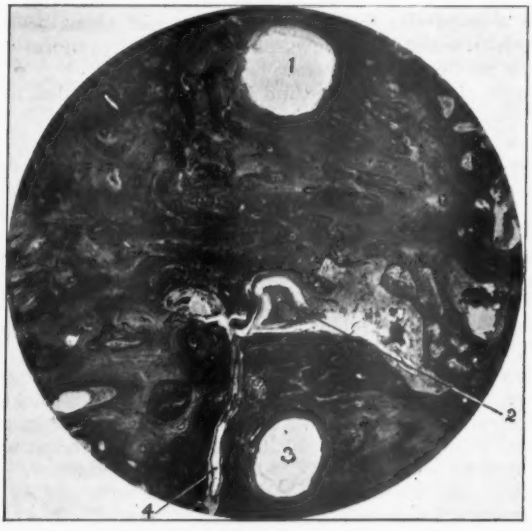

FIG. 1.—W. I., male, aged 70. Horizontal section through right ear, No. 30. (1) Ampullary end of superior canal. (2) Pus in fossa subarcuata. (3) Smooth end of superior canal. (4) Vessel in fossa subarcuata which in this case turns directly inwards and backwards—a possible route of meningeal infection.

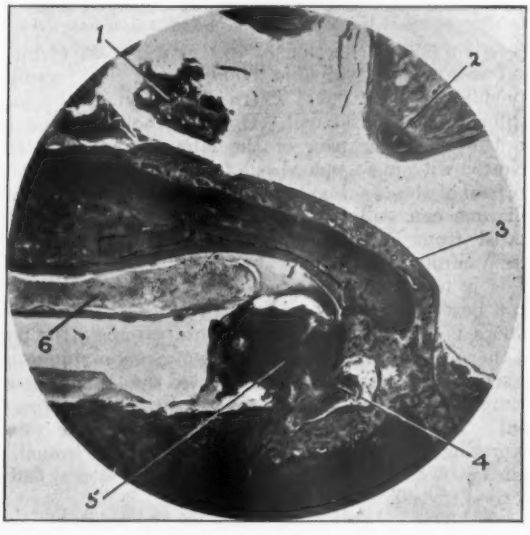

FIG. 4.—Horizontal section through right ear, No. 216. (1) Pus in tympanic cavity. (2) Handle of malleus attached to swollen, infiltrated drumhead. (3) Engorged mucosa of promontory. (4) Pus in niche of round window. (5) Purulent exudate breaking through round window membrane. (6) Pus in scala vestibuli and cochlear canal. Reissner's membrane has disappeared.

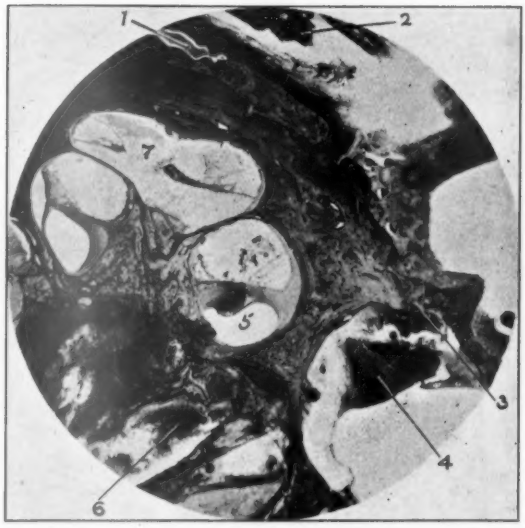

FIG. 3.—Horizontal section through right ear, No. 152. (1) Pus in tympanic end of Eustachian tube. (2) Tensor tympani. (3) Pus entering vestibule through anterior margin of oval window. (4) Pus in vestibule. (5) Scala tympani of basal coil with purulent exudate (6) Meningitis in internal meatus.

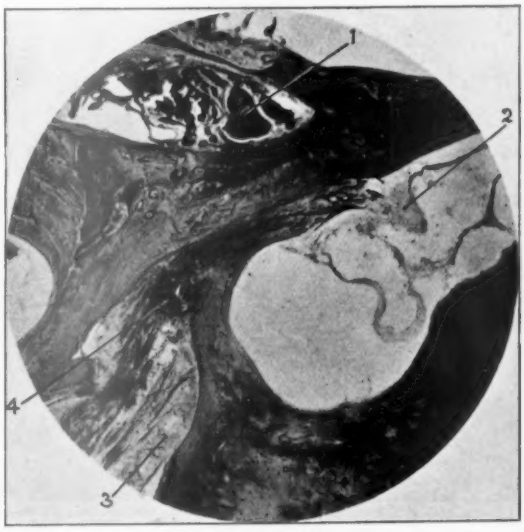

FIG. 2.—Horizontal section through right ear, No. 105. (1) Facial nerve. (2) Desquamating crista of lateral canal. (3) Meningitic infiltration within arachnoid sheath in internal meatus. (4) Abscess in branch of vestibular nerve to lateral canal.

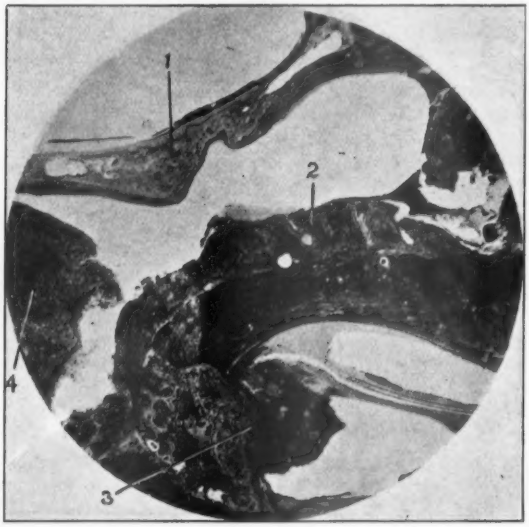

FIG. 7.—Horizontal section through left ear, No. 220. (1) Thickened, engorged, infiltrated drumhead. (2) Swollen, almost polypoid mucosa of promontory. (3) Pus breaking through secondary tympanic membrane into scala tympani. (4) Pus in tympanic cavity.

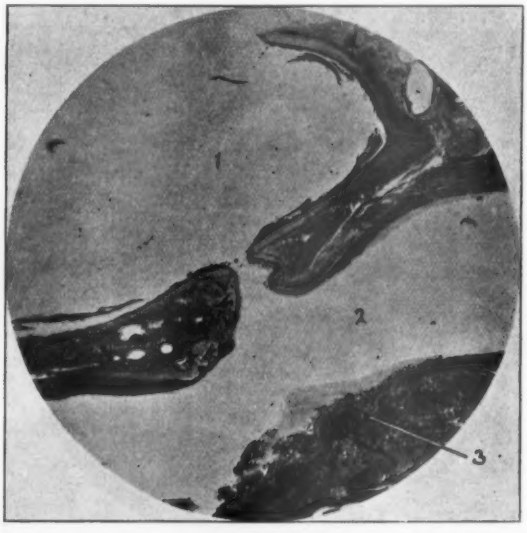

FIG. 8.—Horizontal section through left ear, No. 232, shows the perforation of the left drumhead. (1) External meatus. (2) Tympanic cavity. (3) Engorged and infiltrated mucosa of promontory. Note that the squamous epithelium of the outer surface of the drumhead is not invading the tympanum. The margins of the perforation indeed are covered by mucosa which has grown from the medial or deep surfaces of the drumhead.

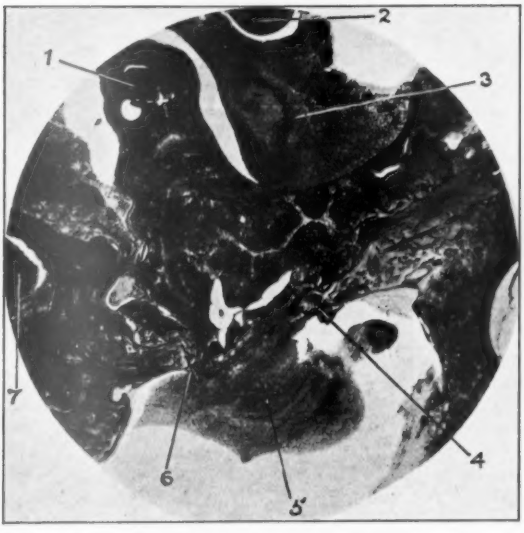

FIG. 5.—Horizontal section through left ear, No. 145. (1) Long process of incus. (2) Handle of malleus. (3) Pus in tympanic cavity. (4) Pus entering vestibule through anterior margin of oval window. (5) Pus in vestibule. (6) Pus entering vestibule through posterior margin of oval window. (7) Facial nerve.

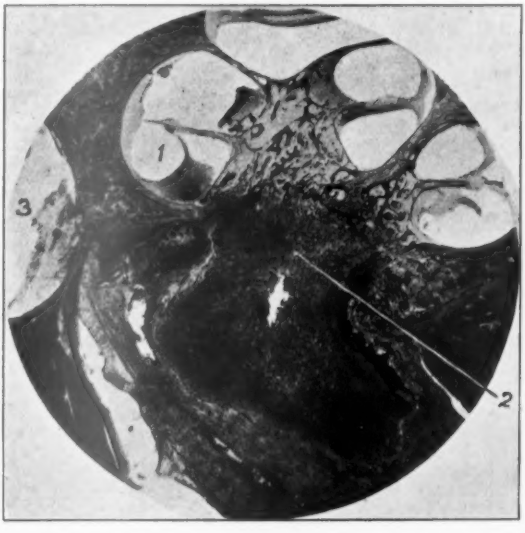

FIG. 6.—Horizontal section through left ear, No. 145. (1) Purulent exudate in scala tympani of basal coil: note connection between this and 2, the abscess formation in the fundus of the internal acoustic meatus. (3) Vestibule.

epidermic layer. The latter is desquamating. There is a small perforation of the lower part of the tympanic membrane, the edges of which are epithelialized. It is noteworthy that the cells from the tympanic mucosa, i.e., those of hypoblastic origin, extend to the outer edge of the perforation, i.e., there is no invasion of epiblastic cells into the tympanum. The Eustachian tube, the tympanum and the window niches show much the same condition as on the right side (figs. 7 and 8).

Cochlea.—There is less pus in the cochlea on this side. The scala tympani of the upper part of the basal coil shows marked purulent infiltration which appears to have passed along the cochlear nerve from the internal meatus. The scala tympani, just internal to the round window membrane, is full of pus which has burst upwards through the basilar membrane and the scala media into the scala vestibuli.

The vestibule and semicircular canals show almost the same conditions as on the right side (fig. 5).

Internal meatus.—The internal meatus is full of pus, indeed the purulent infiltration within the subarachnoid sheath almost amounts to abscess formation (fig. 6).

Commentary.—The case was a hopeless one of malignant disease of the tonsil and lateral wall of the pharynx. When the patient was re-admitted after radium treatment it was found that he had bilateral acute suppurative otitis media and bilateral purulent labyrinthitis. It is of interest that, though there was complete bilateral deafness, vestibular symptoms were almost absent, i.e., there was only a slight nystagmus to right and to left—equal and normal. This phenomenon—or rather absence of phenomenon—in a case of simultaneous acute bilateral labyrinthitis appears to correspond to the condition observed when both ears of a normal individual are syringed at the same time with equal quantities of cold lotion, i.e., there is no nystagmus.

(*In regard to the microscopic examination of this case, and the reproduction of illustrations, the writer begs to acknowledge a grant from the Carnegie Trust Research Fund.*)